105th Congress, 1st Session – – – – – – – – – – – – House Document 105–142

ST. PAUL ISLAND HARBOR, ALASKA

COMMUNICATION

FROM

THE ACTING ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS), THE DEPARTMENT OF THE ARMY

TRANSMITTING

A REPORT ON THE AUTHORIZATION OF HARBOR AND ENVIRONMENTAL RESTORATION IMPROVEMENTS AT ST. PAUL ISLAND HARBOR, ALASKA, PURSUANT TO PUBLIC LAW 104–303 SEC. 101(b)(3)

SEPTEMBER 22, 1997.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

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U.S. GOVERNMENT PRINTING OFFICE

43–883 WASHINGTON : 1997

CONTENTS

Page

Page

APPENDICES ACCOMPANYING THE REPORT OF THE DISTRICT ENGINEER (ONLY APPENDICES B AND D PRINTED)

LIST OF FIGURES

LIST OF TABLES

LETTER OF TRANSMITTAL

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

10 SEP 1997

REPLY TO
ATTENTION OF

Honorable Newt Gingrich
Speaker of the House
of Representatives
Washington, D.C. 20515

Dear Mr. Speaker:

Section 101(b)(3) of the Water Resources Development Act of 1996, authorized harbor and environmental restoration improvements at St. Paul Island Harbor, Alaska. The Secretary of the Army supports the authorization and plans to implement the project through the normal budget process.

The authorized project is described in the report of the Chief of Engineers dated December 23, 1996, which includes other pertinent reports and comments. These reports are in partial response to a resolution adopted by the House Committee on Public Works on December 2, 1970.

The views of the State of Alaska, and the Departments of the Interior and Transportation are set forth in the enclosed report.

The authorized project modifies the existing Federal navigation project to provide for an entrance channel at a depth of 30 feet below mean lower low water (MLLW), with an additional 2 feet of depth for advance maintenance; a 415-by-830 foot maneuvering basin, dredged to a depth of 29 feet below MLLW; a spending beach to reduce wave heights within the harbor; and three submerged offshore reefs, each 1,300 feet long, at a depth of 12 feet below MLLW and located parallel to the existing main breakwater. Mooring dolphins, authorized as part of the existing project are deauthorized. Local service facilities, including the dredging of a moorage area would be provided by the city of St. Paul, the non-Federal project sponsor. The environmental restoration component of the project provides for the construction of a wave energy channel, 100 feet in width, with a bottom elevation of 2 feet above MLLW, across Boulder Spit and realignment of the natural channel into Salt Lagoon, a salt estuary which is located adjacent to the harbor. The restoration feature will increase water circulation and biological productivity and restore approximately 227 acres of aquatic habitat. The authorized project is the national economic development plan.

Based on October 1996 price levels, the total first cost of the authorized project is estimated at about $18,338,000, with a Federal cost of about $11,633,000, and a non-Federal cost of about $6,705,000. This cost includes $15,746,000 for general navigation features, $1,614,000 for sponsor's associated costs, $926,000 for the environmental restoration of Salt Lagoon, and $52,000 for lands, easements, rights-of-way and relocations.

The Office of Management and Budget advises that there is no objection to the submission of the report to the Congress. A copy of its letter is enclosed in the report.

Sincerely,

John H. Zirschky
Acting Assistant Secretary of the Army
(Civil Works)

Enclosure

COMMENTS OF THE OFFICE OF MANAGEMENT AND BUDGET

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

JUL 24 1997

The Honorable John H. Zirschky
Acting Assistant Secretary of the Army
for Civil Works
Pentagon -- Room 2E570
Washington, D.C. 20310-0108

Dear Dr. Zirschky:

As required by Executive Order 12322, we have completed our review of former Assistant Secretary Lancaster's recommendation for the report of the St. Paul Alaska Harbor Improvements Feasibility Report.

The recommendation for this project in his letter of January 23, 1997, is consistent with the policies and program of the President. The Office of Management and Budget does not object to your submitting this report to Congress.

Sincerely,

Kathleen Peroff
Deputy Associate Director
Energy and Science Division

COMMENT OF THE STATE OF ALASKA

STATE OF ALASKA

DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
OFFICE OF THE COMMISSIONER

TONY KNOWLES, GOVERNOR
3132 CHANNEL DRIVE
JUNEAU, ALASKA 99801-[illegible]

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PHONE: (907) 465-3900

November 1, 1996

Mr. David B. Sanford, Jr.
Policy Review Branch
Policy Review and Analysis Division
Attn: CEW-AR (SA)
7701 Telegraph Road
Alexandria, Virginia 22315-3861

Dear Mr. Sanford:

Thank you for the opportunity to review and comment on the proposed project reports:

> Harbor Improvements Interim Feasibility Study and Environmental Assessment, St. Paul, Alaska, August 1996.
>
> Chief of Engineers "Proposed Report", St. Paul Harbor, Alaska.

I concur in the general findings, conclusions and recommendations of the District Engineer Interim Feasibility Report and the specific recommendations of the Chief of Engineers for the construction of the St. Paul Harbor Improvements project.

This concurrence does not reflect current or future budget priorities inherent in any State program and State funding is subject to appropriation by the Alaska Legislature.

Sincerely,

Joseph L. Perkins

Joseph L. Perkins, P.E.
Commissioner

COMMENTS OF THE SECRETARY OF INTERIOR

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

ER 96/635

DEC 4 1996

Mr. Raleigh H. Leef
Acting Chief, Policy Division
Directorate of Civil Works
ATTN: CECW-AR (SA)
7701 Telegraph Road
Alexandria, VA 22315-3861

Dear Mr. Leef:

We have reviewed the Chief of Engineers Proposed Report, Interim Feasibility Report and Environmental Assessment for Harbor Improvements for St. Paul, Alaska. The following comments are offered for your consideration.

Our Anchorage Ecological Services Field Office has been involved in this project from the early planning stages and has completed several site visits, field work and a draft Fish and Wildlife Coordination Act Report. The EA was issued before the Fish and Wildlife Service's FWCA Report was submitted; therefore, although the EA reflects the FWS's recommendations for design changes to mitigate environmental impacts to fish and wildlife resources, the FWCA Report was not appended. The FWCA Report includes resource information and recommendations important to selection of the final preferred alternative for the project and should be included as part of the EA.

The remaining outstanding environmental issue is the Salt Lagoon entrance channel, and a long-term solution to water circulation problems in the lagoon. Corps staff continue to model and explore alternatives, including a surge channel cut through Village Cove Beach, site of a least auklet nesting colony. All concerned parties will have input regarding final resolution of this issue, and, "a final design will be adopted only when it is fully accepted by all the participants" (EA, page 37). Modeling of water circulation patterns will continue for Salt Lagoon and a representative from the FWS will accompany Corps personnel to the Vicksburg Waterways Experiment Station later this winter.

No comments were received from any outside agency, including the Corps, on the draft FWCA Report. However, Alaska Maritime National Wildlife Refuge had several comments, which will be incorporated into the final document. These comments do not alter our earlier recommendations. We have been very pleased with the cooperation and coordination experienced between our agencies thus far and look forward to equally productive negotiations in the future. If you have questions concerning our comments, please contact Ann Rappoport, Supervisor, Anchorage Ecological Services Field Office at (907) 271-2888.

Sincerely,

William R. Taylor

William R. Taylor
Director, Office of Environmental
Policy and Compliance

cc: Colonel Peter A. Topp
District Engineer
Alaska District
Post Office Box 898
Anchorage, Alaska 99506-0898

COMMENTS OF THE DEPARTMENT OF TRANSPORTATION

U.S. Department of Transportation
United States Coast Guard

Commandant
United States Coast Guard

2100 Second Street, S.W.
Washington, DC 20593-0001
Staff Symbol: G-MOR
Phone: (202) 267-0518
FAX: (202) 267-4085

16450
November 25, 1996

Policy Division, Policy Review Branch
Department of the Army
U.S. Army Corps of Engineers
Washington, DC 20314-1000

Dear Sir:

Recently you sent copies of the proposed report for the Chief of Engineers and report of the district engineer on the listed projects. In addition, you sent a letter dated October 25, 1996 requesting an expedited review of these documents. We have reviewed the proposed reports and have no comments to offer.

Chesapeake and Delaware Canal, Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland, sent September 12, 1996, 90 Days ending December 11, 1996.

Saint Paul, Alaska, sent September 17, 1996, 90 days ending December 16, 1996.

New Jersey Shore Protection Study, Brigantine Inlet to Great Egg Harbor Inlet, Absecon Island Interim, sent September 19, 1996, 90 days ending December 18, 1996.

Kaweah River Basin, California, sent September 25, 1996, 90 days ending December 24, 1996.

Thank you for providing the Coast Guard the opportunity to review the proposed reports. We look forward to receiving the final reports when issued.

Sincerely,

for R. E. BENNIS
Captain, U.S. Coast Guard
Chief, Office of Response
By direction

ST. PAUL HARBOR, ALASKA

REPORT OF THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

CECW-PE (10-1-7a)

23 DEC 1996

SUBJECT: St. Paul Harbor, Alaska

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on harbor improvements and environmental restoration at St. Paul, Alaska. It is accompanied by the report of the district and division engineers. These reports are in partial response to a resolution adopted by the Committee on Public Works of the United States House of Representatives on 2 December 1970. The study resolution requested a review of the report of the Chief of Engineers on Rivers and Harbors in Alaska, published as House Document 414, 83rd Congress, 22nd Session; and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at the present time. Preconstruction engineering and design activities for the St. Paul Harbor and restoration project will be continued under the authority provided by the 2 December 1970 resolution.

2. Section 101(b)(3) of the Water Resources Development Act of 1996 (WRDA 96), Public Law 104-303, authorized construction of a navigation and environmental restoration project at St. Paul Harbor, Alaska, subject to completion of a final report of the Corps of Engineers on or before December 31, 1996, and subject to the conditions recommended in that final report. This report constitutes the final report of the Corps of Engineers required by section 101(b). The authorizing language for the St. Paul Harbor project reflects a cost of $18,981,000, with an estimated Federal cost $12,239,000. Section 101(b)(3) cited project costs and cost sharing from

earlier information provided by the Corps. The cost estimate and cost sharing have been adjusted to reflect current information on the project authorized by Section 101(b) of WRDA 1996. Paragraph 4 of this document contains the current information.

3. The reporting officers recommend modification of the existing authorized Federal navigation project and restoration of tidal flushing in Salt Lagoon, adjacent to the harbor. The plan consists of deepening the existing entrance channel, enlarging and deepening the maneuvering basin, constructing a spending beach and three offshore reefs, and restoring the historic storm-induced water exchange into Salt Lagoon. The entrance channel would be dredged to -30 feet mean lower low water (MLLW), with an additional 2 feet for advance maintenance; it would have an approach perpendicular to the main breakwater, with a 90 degree turn into the harbor, between the main and detached breakwaters. The width of the channel would vary from 250 feet in its approach up to 350 feet in the turn; it would decrease to 150 feet entering the harbor. The existing maneuvering area and mooring basin would be enlarged to a 415-by-830-foot maneuvering basin, dredged to a depth of -29.0 MLLW. The spending beach would be constructed in the area intended for the installation of mooring dolphins under the original project authorization, adjacent to the detached breakwater, to reduce wave heights within the harbor; it would be constructed to a crest elevation of +4 feet MLLW, using material dredged from the maneuvering basin. The mooring dolphins would be deauthorized; this feature is no longer required because of changes in anticipated harbor operations that have occurred since the initial design and construction of the existing project. The three offshore reefs, each 1,300 feet in length would be constructed to a depth of -12 feet MLLW, parallel to the main breakwater. A wave energy channel, 100 feet in width, with a bottom elevation of +2 feet MLLW would be constructed across Boulder Spit and the natural entrance channel into Salt Lagoon would be realigned to its

location and configuration to restore water circulation and biological productivity to the lagoon. Dredged material would be placed at the new city landfill, a 7.7 mile haul distance, and in the spending beach island; approximately 60,000 of the 379,000 cubic yards of material dredged, would be required for the spending beach.

4. The estimated first cost of the authorized project, based on October 1996 price levels, is $18,338,000, of which $11,633,000 would be Federal and $6,705,000 would be non-Federal. This cost includes $15,746,000 for general navigation features (GNF), $1,614,000 for sponsor's associated costs, $926,000 for the environmental restoration of Salt Lagoon, and $52,000 for lands, easements, rights-of-way and relocations (LERR). The non-Federal sponsor would be responsible for providing all lands, easements, rights-of way, and relocations for both the navigation and environmental restoration features; all inner harbor improvements, including the cost of deepening the moorage basin; a portion of the cost of GNF; and 25 percent of the cost of environmental restoration features. In addition, the sponsor would be responsible for operating and monitoring the environmental restoration features. Total average annual charges for the navigation portion of the project (including advance maintenance), based on a discount rate of 7-3/8 percent and a 50-year period for economic analysis, are $1,546,000. Average annual benefits are estimated at $2,613,000, and the benefit-cost ratio is 1.7. The restoration feature would increase flushing of Salt Lagoon and restore 227 acres of aquatic habitat. The restoration feature is justified based on environmental outputs and is not included in the economic analysis. The cost sharing for restoration follows the general principles of Section 1135 of the Water Resources Development Act of 1986, as amended. The recommended plan is the national economic development plan.

5. Washington level review indicates that the recommended plan is technically sound, economically justified, and environmentally acceptable. The plan conforms with essential elements of the U.S. Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and complies with other Administration and legislative policies and guidelines on project development. Also the views of interested parties, including Federal, State, and local agencies have been considered.

6. I generally concur in the findings of the reporting officers. Accordingly, I recommend implementation of the authorized project generally in accordance with the reporting officers' recommended plan, with such modifications as in the discretion of the Chief of Engineers may be advisable, and subject to applicable cost-sharing and financing requirements. My recommendation is made with the provision that, prior to implementation of the project, the non-Federal sponsors shall enter into binding agreements with the Federal Government to comply with the following requirements. For the separable and joint navigation improvements and restoration allocated to the harbor and lagoon, at St. Paul, Alaska, the non-Federal sponsor shall:

a. Provide all local service facilities and, for so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate, at its own expense, both the local service facilities and environmental restoration features, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

b. Provide all lands, easements, and rights-of-way, including those lands, easements, and rights-of way required for dredged or excavated material disposal areas and environmental restoration, and perform or ensure the performance of all relocations determined by the Federal

Government to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation and restoration features;

c. Accomplish all removals determined necessary by the Federal Government other than those removals specifically assigned to the Federal Government;

d. Provide, during the period of construction, a cash contribution equal to the following percentages of the total cost of construction of the general navigation features:

(1) 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet; and

(2) 25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet;

e. Provide any additional amounts as are necessary to make its total contribution equal to 25 percent of the total project costs assigned to environmental restoration;

f. Repay with interest, over a period not to exceed 30 years following completion of construction of the project, up to an additional 10 percent of the total cost of construction of general navigation features depending upon the amount of credit given for the value of lands, easements, rights-of-way, and relocations provided by the non-Federal sponsor for the general navigation features. If the amount of credit exceeds 10 percent of the total cost of construction of the general navigation features, the non-Federal sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, and relocations, in excess of 10 percent of the total cost of construction of the general navigation features;

g. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the general navigation and restoration features for the purpose of inspection, and, if necessary, for the purpose of operating, maintaining, repairing, replacing, and rehabilitating the general navigation and restoration features;

h. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, any betterments and local service facilities, except for damages due to the fault or negligence of the United States or its contractors;

i. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of three years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction of the general navigation and restoration features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR Section 33.20;

j. Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, or rehabilitation of the general navigation and restoration features. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

k. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation and restoration features;

l. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA;

m. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation and restoration features, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

n. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army;" and

o. Provide a cash contribution equal to the following percentages of the total historic preservation mitigation and data recovery costs attributable to commercial navigation and environmental restoration that are in excess of 1 percent of the total amount authorized to be appropriated for commercial navigation and environmental restoration, respectively:

(1) 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet;

(2) 25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet; and

(3) 25 percent of the costs attributable to environmental restoration.

JOE N. BALLARD
Lieutenant General, USA
Chief of Engineers

REPORT OF THE DISTRICT ENGINEER

HARBOR IMPROVEMENTS
INTERIM FEASIBILITY REPORT

ST. PAUL, ALASKA

ADDENDUM

This addendum changes the designation of the Salt Lagoon habitat improvement portion of the St. Paul Harbor project from mitigation to restoration. The cost-sharing requirements for construction, LERRD (lands, easements, rights-of-way, relocation, and disposal areas) and O&M (operation and maintenance) are changed by this addendum for the Salt Lagoon portion of this project to comply with the cost-sharing guidance contained in EC 1105-2-210.

Total fully funded construction costs of the Salt Lagoon restoration are estimated to be $985,000, with a Federal cost of $739,000 (75 percent) and a non-federal cost of $246,000 (25 percent). The non-federal sponsor is responsible for all LERRD costs necessary for Salt Lagoon restoration. In addition to initial project costs, the non-federal sponsor is responsible for 100 percent of the operation, maintenance, repair, rehabilitation, and replacement (OMRR&R) costs for Salt Lagoon restoration features. Initial Salt Lagoon costs are detailed in the enclosed tables 12 and 13, which replace tables 12 and 13 in the report.

TABLE 12.--*Apportionment of construction costs ($000) for Salt Lagoon restoration*

Item	Fully funded expenditures Federal	Non-Federal
Construction	739	246[a]
LERRD[b]		28

[a] Assumes July 1998 as midpoint construction date.
[b] Lands, easements, rights-of-way, utility relocations, and dredge spoil disposal areas.

TABLE 13.--*Detailed cost estimate for Salt Lagoon restoration, St. Paul, Alaska (October 1995 price level)*

Item	Qty.	Unit	Unit price ($)	Contin-gency	Shared NED costs ($000)[a] Federal	Local	TOTAL
Restoration							
Mobilization & demob.	1	LS	27,000	20%	24	8	32
Salt Lagoon wave energy channel							
Phase I							
Excavate & place boulders	12,000	yd^3	19.69	20%	213	71	284
Excav. spoils & build jetty	17,000	yd^3	11.02	20%	169	56	225
Phase II							
Excavate & place boulders	12,000	yd^3	19.69	20%	212	71	283
SUBTOTAL					594	198	792
CONSTRUCTION CONTRACTS					618	206	824
Engineering and design	1	LS	35,000	10%	29	10	39
Construction management	1	LS	41,000	10%	34	11	45
Subtotal Restoration					**681**	**227**	**908**
Lands and damages							
Acquisitions	4	acres	5,000	6%		21	21
Administrative cost	1	LS	8,000	6%		5	5
SUBTOTAL						26	26
TOTAL PROJECT COST					**681**	**253**	**934**

[a] Features showing Federal costs are for Salt Lagoon restoration. These can be paid in part by the Federal Government, subject to current cost-sharing laws.

SUMMARY

This study recommends a plan for harbor improvements and Salt Lagoon mitigation at St. Paul Harbor on St. Paul Island, the largest and northernmost of the Pribilof Islands in the eastern Bering Sea of Alaska. The improvements would accommodate increased boat and ship traffic, including refrigerated cargo vessels in excess of 300 feet in length. The improvements would also reduce the problem of storm waves that overtop the main breakwater and damage facilities and vessels. The mitigation aspects of the project would increase water circulation and restore biological productivity to the adjacent Salt Lagoon.

St. Paul Island has a land area of 44 square miles. It is one of the two populated islands in the Pribilofs; the other is St. George. St. Paul is in an area known for its vast marine habitat and fisheries, especially crab. St. Paul Harbor provides the only facility for boat moorage and service in the region except for the small harbor on St. George Island, 40 miles southwest.

Harbor construction at St. Paul was completed in 1990. The existing harbor was designed to support a fishing fleet one-third the size of the current operating fleet. It was not intended to have any floating or shore-based processing plants. It was designed to accommodate unladen fishing vessels going into harbor to refuel and stock provisions. The design vessel was 110 feet in length with an unladen draft of 12 feet.

By contrast, St. Paul Harbor currently serves a fleet of 230 transient vessels during the crabbing season. Twenty-seven floating processors were within the 3-mile limit there in 1994. Within the harbor are three shore-based processors, two floating and one onshore. St. Paul is in a rapid growth cycle; well-established seafood processors are investing capital to relocate and build processing facilities there. Based on current and anticipated harbor use, the design vessel is 325 feet long with a 50-foot beam and a 23-foot loaded draft.

The recommended plan has the following components: a dredged entrance channel at -30 ft MLLW with an additional 2 ft for advance maintenance; a maneuvering basin at -29 ft MLLW; a spending beach on the lee side of the detached breakwater; and three offshore reefs parallel to the main breakwater, each 1,300 ft long, at a depth of -12 ft MLLW. Also, as mitigation to restore water circulation and biological productivity to Salt Lagoon, a wave energy channel 100 ft wide at +2 ft MLLW across Boulder Spit is recommended. The natural entrance channel into the lagoon would be realigned to its original location and configuration.

The plan has a total National Economic Development (NED) project cost of $18,047,000, an equivalent annual NED cost of $1,566,000, and annual benefits of $2,613,000. With the current benefit categories, the benefit/cost ratio is 1.7. The plan also includes the Salt Lagoon mitigation at a cost of $934,000.

PERTINENT DATA

Harbor Improvements, St. Paul, Alaska
Recommended Plan

Excavations:	Area (ft^2)	Bottom elevation	Dredging volume (yd^3)
Maneuvering basin	473,000[a]	-29 ft MLLW	180,000
Mooring area		-29 ft MLLW	40,000
Entrance channel	425,000	-30 ft MLLW[b]	130,000[c]
TOTAL	898,000		350,000

Offshore reefs (3):	Length	Crest elev.	Crest width	Rock volume (yd^3)	
	1,300 ft	-12 ft MLLW	20 ft	Armor rock	75,000
				Bedding	42,000
				TOTAL	117,000

Spending beach:	Quantities (yd^3)
Armor, 1,000#	10,000
Armor, 200# max	8,000
Total armor	18,000
Fill	60,000

Salt Lagoon mitigation:	
Channel area	3.7 acres
Elevation	+2 ft MLLW
Width	100 ft
Excavation	29,000 yd^3
Rock	12,000 yd^3

[a] Maneuvering basin and mooring area combined.
[b] With an additional 2 feet for advance maintenance.
[c] Advance maintenance accounts for 40,000 yd^3 of the entrance channel dredging.

PROJECT CONSTRUCTION COSTS ($000)[a]

Item	Federal	Non-federal	Total
General Navigation Features[b]	11,513	4,952	16,465
Local NED-associated costs[c]	---	1,582	1,582
Total NED costs	**11,513**	**6,534**	**18,047**
NED investment cost (includes interest during construction)			18,735
Interest and amortization of NED investment cost			1,466
Ave. annual NED maintenance cost			100
Total average annual cost			1,566
Average annual NED benefits			2,613
Net annual NED benefits			1,047
Benefit/cost ratio (7-5/8% interest)			1.7
Salt Lagoon mitigation	726	208	934

[a] Basic assumptions:
(1) October 1995 price levels.
(2) 50-year project life.

[b] Cost sharing reflects provisions of the Water Resources Development Act of 1986.
[c] NED = National Economic Development.

GLOSSARY

Abbreviations, Acronyms, and Technical Terms

ABC = allowable biological catch
ADF&G = Alaska Department of Fish and Game
ADOT/PF = Alaska Department of Transportation and Public Facilities
BCR = benefit/cost ratio
CDQ = community development quota
CERC = Coastal Engineering Research Center; part of WES
CPUE = catch per unit of effort
EBS/AI = Eastern Bering Sea/Aleutian Islands
EEZ = (U.S.) Exclusive Economic Zone, where the United States manages the fisheries exclusively; 3-200 nautical miles from shore
ER = Engineering Regulation
GI = General Investigations. This is the type of Corps study specifically authorized by Congress. (See Continuing Authority.)
ft = foot, feet
ft^2 = square foot, feet
ft^3 = cubic foot, feet
gal = gallon(s)
General Navigation Features = Features of a project which can be paid for in part by the Federal Government through the Corps of Engineers. A breakwater is a general navigation feature.
H = horizontal
h = hour(s)
IPHC = International Pacific Halibut Commission
lb = pound(s)
LERRD = lands, easements, rights-of-way, relocation, and disposal areas
LOA = Length Overall (said of a vessel)
MLLW = mean lower low water
mi/h = miles per hour
mo = month(s)
NED = National Economic Development. NED features of a project are those that increase the net value of goods and services provided to the economy of the United States as a whole.
NEPA = National Environmental Policy Act
NMFS = National Marine Fisheries Service
NPFMC = North Pacific Fishery Management Council
NRC = Natural Resources Consultants, Inc.
O&M = operation and maintenance
OMRRR = operation, maintenance, repair, replacement, and rehabilitation
PED = preconstruction engineering and design
PL = Public Law
SPM = *Shore Protection Manual*
TAC = total allowable catch
TDX = Tanadgusix, the St. Paul village corporation
TINRO = Russian federal fisheries agency
USCG = U.S. Coast Guard
USFWS = U.S. Fish and Wildlife Service
V = vertical
WES = Waterways Experiment Station (of the U.S. Army Corps of Engineers)
yd^3 = cubic yard, yards
yr = year(s)

CONVERSION TABLE FOR SI (METRIC) UNITS

Units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To obtain
cubic yards	0.7646	cubic meters
cubic yards per year	0.7646	cubic meters per year
Fahrenheit degrees	*	Celsius degrees*
feet	0.3048	meters
feet per second	0.3048	meters per second
inches	2.54	centimeters
knots (international)	0.5144444	meters per second
miles (U.S. statute)	1.6093	kilometers
miles (nautical)	1.8520	kilometers
miles per hour	1.6093	kilometers per hour
pounds (mass)	0.4536	kilograms
yards	0.9144	meters

* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: $C = (5/9)(F - 32)$.

ACKNOWLEDGMENTS

This report was prepared by the staff of the Alaska District, U.S. Army Corps of Engineers, in Anchorage, Alaska. The study manager was Mr. Clarke Hemphill of the Project Formulation Section in the Civil Works Branch, Engineering Division of the Alaska District. Ms. Charlotte Kirkwood managed the study for the city of St. Paul, the non-federal sponsor.

Economic analyses were performed by Mr. Andrew W. Miller of the Economics Section, Civil Works Branch, in cooperation with Natural Resources Consultants Inc., of Seattle, WA, a consultant to the city of St. Paul. Mr. John Burns of the Environmental Resources Section, Civil Works Branch, was principal preparer of the Environmental Assessment and of the report section on the Salt Lagoon mitigation.

The hydraulic design analysis was done by Mr. Ken Eisses and Mr. Alan Jeffries of the Hydraulics Hydrology Section of Civil Works Branch. Mr. Ray Bottin and Mr. Don Ward of the Waterways Experiment Station, Coastal Engineering Research Center, conducted the two- and three-dimensional model studies.

The project cost was estimated by Mr. Mel Zimmermann of Cost Engineering Branch, Engineering Division. Mr. Guy Hopson of Real Estate Division analyzed the real estate requirements. The report was edited by Ms. Carolyn Rinehart and Ms. Diane Walters of Civil Works Branch. Mr. Bart Lane and Mr. Jim Fuhrer of Civil Works Branch prepared the figures.

These investigations were conducted under the direction of Mr. Claude V. Vining, Chief, Engineering Division; Mr. Kenneth E. Hitch, Chief, Civil Works Branch; Mr. Carl D. Stormer, Chief, Project Formulation Section; Mr. Ken Eisses, Chief, Hydraulics and Hydrology Section; Mr. Andrew W. Miller, Chief, Economics Section; and Mr. Guy R. McConnell, Chief, Environmental Resources Section.

Commander and District Engineer of the Alaska District during this study was Colonel Peter A. Topp, Corps of Engineers.

HARBOR IMPROVEMENTS
INTERIM FEASIBILITY REPORT

ST. PAUL, ALASKA

1. INTRODUCTION

1.1 Study Authority

This feasibility study was recommended in a July 1995 report by the Alaska District, U.S. Army Corps of Engineers, entitled "Reconnaissance Report for Harbor Expansion, St. Paul, Alaska."

This study is authorized by a resolution adopted on December 2, 1970, by the Committee on Public Works of the U.S. House of Representatives. The resolution states:

> *Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports of the Chief of Engineers on Rivers and Harbors in Alaska, published as House Document Numbered 414, 83rd Congress, 22nd Session; and other pertinent reports, with a view to determine whether any modifications of the recommendations contained therein are advisable at the present time.*

1.2 Scope of Study

This feasibility study continues the process that led to construction of the present St. Paul Harbor in 1990. The harbor officially opened in August of that year. This study investigates improvements for the entrance channel and maneuvering basin and solutions to reduce storm waves' overtopping and transmitting through the main breakwater. The study evaluates whether the mooring dolphins and dock construction proposed in the original project should be replaced with other features that better support the current use of the project. Mitigation measures to reduce the ongoing degradation of water quality in the nearby Salt Lagoon are also investigated.

1.3 Study Participants

The city of St. Paul and the Corps' Alaska District have conducted this feasibility study as a partnership under the terms of a cost-sharing agreement. The costs of this study have been shared equally, and the study management team includes representatives of both the city of St. Paul and the Alaska District. Other agencies and organizations contacted or contributing to this study include:

- U.S. Fish and Wildlife Service
- U.S. Environmental Protection Agency (EPA)
- National Marine Fisheries Service
- State of Alaska
  - Department of Transportation and Public Facilities
  - State Historic Preservation Officer
  - Department of Governmental Coordination
  - Department of Natural Resources
- Pribilof Islands Joint Management Board
- Tanadgusix Corporation (the local Native corporation)
- Tribal Government of St. Paul Island
- Central Bering Sea Fishermen's Association
- St. Paul Interagency Working Group

1.4 Previous Studies

These studies have been conducted on the St. Paul harbor, with the most recent listed first:

1.4.1 Investigations by the Corps of Engineers.

Alaska District. 1995 (Jul). "Reconnaissance Report for Harbor Expansion," Anchorage.

Alaska District. 1995. "St. Paul Salt Lagoon Project, Section 1135," Anchorage. This study was directed at opening a new channel on Boulder Spit outside the St. Paul harbor and enlarging the entrance channel to Salt Lagoon. These actions would improve circulation and water quality in the lagoon during storm events, benefiting wildlife.

Alaska District. 1988 (May). "General Design Memorandum, St. Paul Island Harbor, St. Paul Island, Alaska," Anchorage. The harbor was authorized as a project for navigation in Section 202 of the Water Resources Development Act of 1986. Construction and maintenance of two breakwaters and a maneuvering channel were recommended, with the local sponsor responsible for constructing the mooring basin, mooring facilities, and access road.

Waterways Experiment Station, Coastal Engineering Research Center (WES-CERC). 1988 (Sep). "St. Paul Harbor Breakwater Stability Study," TR CERC-88-10, Vicksburg, MS.

WES-CERC. 1988 (Sep). "St. Paul Harbor Design for Wave and Shoaling Protection, St. Paul Island, Alaska," TR CERC 88-13, Vicksburg, MS.

Alaska District. 1988 (Feb). "Environmental Assessment, St. Paul Island Harbor, St. Paul Island, Alaska," Anchorage.

Alaska District. 1982 (Dec). "Final Harbor Feasibility Report and Environmental Impact Statement, St. Paul Island, Alaska," Anchorage. This report describes the plan authorized by the Water Resources Development Act of 1986, Public Law (PL) 99-662. As modified by the Chief of Engineers' Report of August 10, 1983, it was transmitted by the Assistant Secretary of the Army for Civil Works (ASA[CW]) to the Office of Management and Budget (OMB) on July 3, 1985, and returned by OMB to ASA(CW) on November 18, 1986.

1.4.2 Studies by Others.

DHI Consulting Engineers, Dames & Moore, Inc., and Coastline Engineering. 1994 (May 5). "Report of Findings, Technical Addendum to U.S. Army Corps of Engineers Permit No. 870522, Marine Fill, Harbor Hydrodynamics and Salt Lagoon Impacts, St. Paul Island Harbor Expansion," prepared for the Tanadgusix Corporation.

Tetra Tech, Inc. 1987 (Feb). "Alaska St. Paul Harbor and Breakwater Technical Design Report," prepared for the city of St. Paul.

Woodward-Clyde Consultants. 1983 (Nov). "St. Paul Harbor Geotechnical Investigation," prepared for Norgaard Consultants, 625 West Fifth Avenue, Anchorage, Alaska 99501.

2. REGIONAL DESCRIPTION

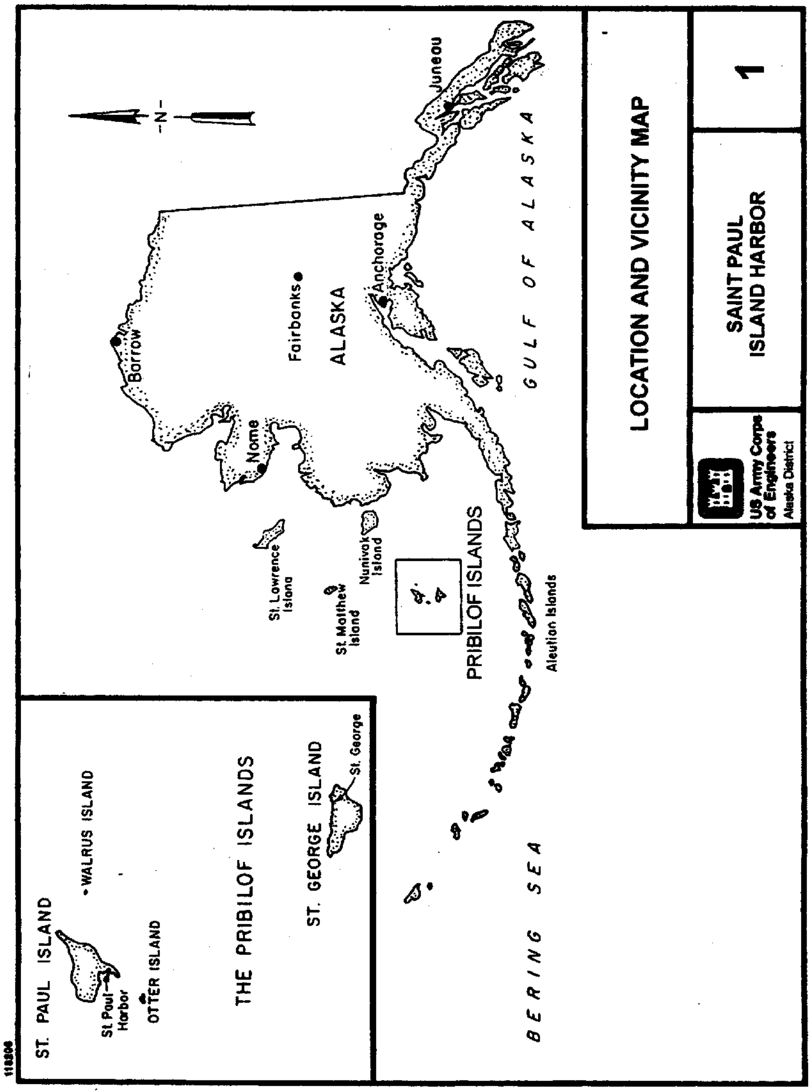
2.1 Socioeconomic Setting

St. Paul Island is the largest and northernmost of the Pribilof Islands in the eastern Bering Sea of Alaska, with a land area of 44 square miles. Only two of the Pribilof Islands are populated, St. Paul with 800 people and St. George with 290 people. Two-thirds of the St. Paul population is Alaska Native. St. Paul Harbor provides the only facility for boat moorage and service in the region except for a small harbor on St. George Island. (See figure 1.)

Economic conditions on the Pribilof Islands are unique. Before October 1983, St. Paul was classified as a Federal Government installation. The island was the center of fur sealing activities under the administration of the National Marine Fisheries Service (NMFS). Since the NMFS withdrew from the island in 1983, the community has had to find other sources of employment. The cessation of Government-supported sealing was an extreme setback; the NMFS accounted for more than 60 percent of the total labor force employment and operated the island's basic services.

The city of St. Paul assumed responsibility for land use planning, utility services, financial and accounting systems development, and numerous community services. The city developed a new economic base related to fisheries, constructing 750 feet (ft) of breakwater and 200 ft of dock in 1986. Under Section 204(e) of Public Law 99-662, the city of St. Paul constructed the existing project in 1990, extending the main breakwater to 1,800 feet and installing a 970-ft detached breakwater in the lee of the main breakwater. The city also dredged the harbor to -23 ft MLLW, substantially deeper than the authorized elevation of -18 ft MLLW. Figure 2 is a plan drawing of the existing St. Paul Harbor.

Section 204(e), the authority for construction, authorized sponsors to construct federally authorized projects with their own funds and then be reimbursed for the Federal share. Completion of the harbor, together with rapid changes in the fishing industry, has placed major demands on St. Paul Harbor to better accommodate the new mix of commercial fishing vessels, onshore and floating processors, and cargo vessels and barges. Use of the harbor over the last 5 years has surpassed all economic forecasts. Vessels in the 160-ft class routinely call on the harbor, which was originally intended as a refueling and water supply port for seven 110-ft vessels. Currently three


ST. PAUL ISLAND
WALRUS ISLAND
St Paul Harbor
OTTER ISLAND
THE PRIBILOF ISLANDS
ST. GEORGE ISLAND
St. George
BERING SEA
PRIBILOF ISLANDS
Aleutian Islands
St. Lawrence Island
St. Matthew Island
Nunivak Island
Nome
Barrow
Fairbanks
ALASKA
Anchorage
Juneau
GULF OF ALASKA
N
LOCATION AND VICINITY MAP
SAINT PAUL ISLAND HARBOR
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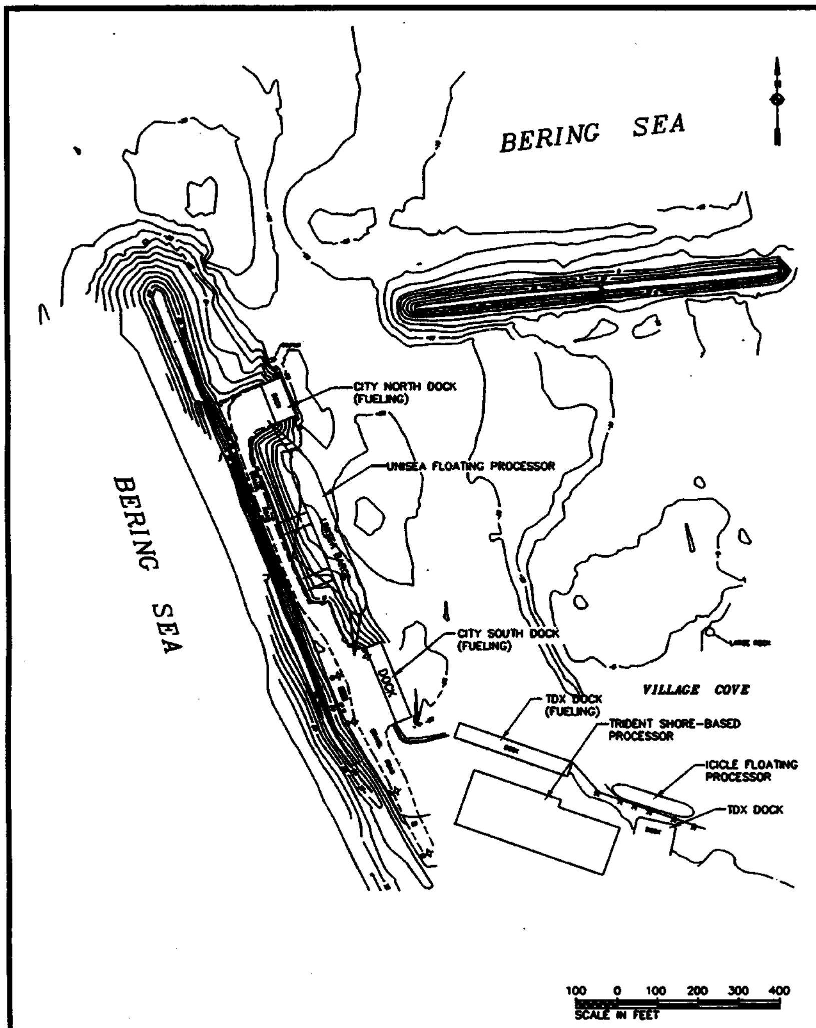
US Army Corps of Engineers
Alaska District



ALASKA DISTRICT CORPS OF ENGINEERS CIVIL WORKS BRANCH	EXISTING HARBOR FACILITIES ST. PAUL ISLAND HARBOR	2

shore-based processors are located in the harbor, and vessels as large as 275 ft with 21-ft draft have called there.

2.2 Hydrology and Hydraulics

2.2.1 Climate.

The climate is maritime, with considerable cloudiness, heavy fog, high humidity, and restricted daily temperature fluctuations. Summer temperatures reach the mid-fifties. The average annual precipitation is near 24 inches. April is generally the driest month; precipitation increases gradually to the wettest months of August, September, and October. Frequent storms occur from October to April, often accompanied by gale-force winds to produce blizzard conditions. However, periods of high wind are characteristic throughout the year. The icepack occasionally moves south to surround the island between January and May, under the influence of prolonged north and northeast winds.

2.2.2 Tides and Water Levels.

Tide levels at St. Paul, referenced to Mean Lower Low Water (MLLW), are presented in table 1. Extreme high tide levels result from the combination of astronomic tides and rises in local water levels due to atmospheric and wave conditions.

TABLE 1.--*St. Paul tide levels (feet)*

Highest Tide (estimated)	+6.0
Mean Higher High Water (MHHW)	+3.2
Mean High Water (MHW)	+3.0
Mean Sea Level (MSL)	+2.0
Mean Low Water (MLW)	+1.0
Mean Lower Low Water (MLLW)	0.0
Lowest Tide (estimated)	-2.5

Source: NOAA Tide Tables, 1980.

2.2.3 Currents.

The *U.S. Coast Pilot No. 9* and "Tidal Current Tables 1987, Pacific Coast of North America and Asia" (NOAA 1986) indicate that currents near Village Cove are primarily tidal and are typically 1 to 2 knots, occasionally increasing to 3 knots when augmented by strong winds. The strongest nearby currents (to 3 knots) are encountered southeast of Village Cove between Reef Point and Otter Island.

2.2.4 Ice Conditions.

The icepack in the northern Bering Sea occasionally moves south and surrounds the island during periods of prolonged north and northeast winds between January and May. During recent years, the southward limit of this movement has been between St. Paul and St. George Islands. Mariners are warned by NOAA charts against the possibility of entrapment in Village Cove. An icebreaker has never been necessary for access to the island.

2.2.5 Wind.

Periods of high wind can occur in the island area throughout the year. The frequent storms from October to April are often accompanied by gale-force winds.

2.2.6 Waves.

The project area is directly exposed to deep-water waves approaching from the west and southwest. The exposure window is bounded by azimuths 210 degrees and 294 degrees relative to true north. Deep-water waves approaching from the south and southeast are partially sheltered by St. George Island and Otter Island and diffract around Reef Point before impinging on the project site. These waves therefore undergo considerable energy reduction before reaching the site. Village Cove is in the lee of St. Paul Island for waves approaching from northwest clockwise through southeast.

Although data are sparse in the area, analysis of available information indicates that significant wave heights exceeding 25 ft can be expected offshore of St. Paul Harbor in deep water on at least an annual basis. The design wave for the existing breakwater was determined by the transformation of deep-water waves by refraction and shoaling to the breakwater location, while limiting the maximum breaking wave height by water depth. This analysis resulted in a maximum wave height of 25 ft based on the offshore depth-limiting conditions.

2.3 Environmental Setting

2.3.1 General.

An estimated 250,000 sea birds of 11 species use St. Paul Island for nesting and rearing young. The most abundant species are thick-billed murre, common murre, black-legged kittiwake, parakeet auklet, and least auklet. A large least auklet colony exists on Village Cove beach. Lesser numbers of waterfowl, shore birds, and songbirds are found on the island as either residents or migrants. Salt Lagoon, the only salt estuary in the Bering Sea, is an important resource for migrating sandpipers and turnstones as well as migratory Eurasian species. Waterfowl occasionally use the freshwater ponds on St. Paul Island.

Land mammals inhabiting St. Paul Island include reindeer, house mouse, Pribilof shrew, and arctic fox (blue phase). Reindeer were transplanted to St. Paul Island in 1911 to provide subsistence meat for the Native population. Reindeer now roam freely on the island and are managed by the St. Paul tribal government. Foxes are relatively abundant, particularly near bird colonies and on the main breakwater.

Northern fur seals, Steller sea lions, and harbor seals are abundant on St. Paul Island during portions of the year. The northern fur seal is the most abundant. Seals come to the Pribilofs for breeding and pupping from early May to October, feeding within a 200-mile radius of the islands. Fur seals begin migrating toward southern California and northern Japan during October and remain at sea until returning to the Pribilofs in May. They feed on anchovy, hake, herring, Alaska pollock, and other fish and squid. Other marine mammals, principally whales and porpoises, frequently are observed offshore at St. Paul. Fur seals are seen inside the harbor and in the entrance to Salt Lagoon.

2.3.2 Endangered and Threatened Species.

Two species of birds, six species of whales, and one sea mammal listed in the "United States List of Endangered and Threatened Wildlife and Plants" have been reported on or in the vicinity of the Pribilof Islands. The short-tailed albatross is reported as accidental in the Pribilofs, while a confirmed sighting of the Eskimo curlew has not occurred since the late 1880's. The six whales are the blue, finback, sei, humpback, right, and sperm. The sea mammal is the Steller sea lion, which occurs at two locations on St. Paul Island but not in the vicinity of the harbor.

Coordination regarding potential effects to endangered and threatened species was conducted with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) during preparation of the 1982 environmental impact statement and the February 1987 environmental assessment. The agencies concur with the finding that the proposed project, as described in this document, will have no effect on any endangered or threatened species or their critical habitats. (See the Draft Fish and Wildlife Coordination Act Report in EA appendix 2 following the Environmental Assessment.)

2.3.3 Resources of Concern.

There are three areas of environmental concern associated with the proposed harbor improvements:

Sea Birds. Boulder Spit, the natural northeast boundary of Village Cove, is the nesting ground for thousands of least auklets. Human access to this sea bird colony could impact these birds' use of the boulder habitat.

St. Paul Island is rat-free. The introduction of rats onto the island could cause significant adverse impacts to all the sea bird colonies on the island. The city of St. Paul, in conjunction with USFWS, has an active rat prevention program. The use of the harbor by foreign freighters increases the probability of rats coming to the island.

Fur Seals. Since construction of the harbor, the number of fur seals entering Village Cove has increased considerably. Approximately 300 fur seal pups were observed in the harbor during the summer of 1995. More fur seals in Village Cove could lead to an increase in vessel or human conflict with the seals. This situation could adversely affect fur seals and could lead to restrictions on use of the harbor by the fishing fleet.

Salt Lagoon. Salt Lagoon, with its associated intertidal areas, is the only salt lagoon on the island and in the central Bering Sea. It is an extremely productive body of water and supports large numbers of shorebirds, waterfowl, and other avian species from spring through fall. The heavy invertebrate populations also support juvenile fishes in Village Cove. According to the last biological survey performed by scientists from the Moscow Institute, degradation of Salt Lagoon is occurring rapidly.

2.4 Geology

The Pribilof Islands were formed through volcanic activity. St. Paul Island is made up predominately of lava flows and sills of basaltic habit, with minor amounts of pyroclastic tuffaceous material and glacial sediments (Barth 1956). No trace of glaciation is seen on the surface of the island, but evidence of glacial striation exists on St. George Island, and Pleistocene sediments of apparent glacial origin are exposed in vertical sections along some of the steep sea cliffs near the village of St. Paul.

Surface material in the proposed project area is generally sandy with scattered cobbles and boulders. Data from test borings, as well as from pile driving logs and dredging logs, indicates that subsurface material in the project area is black/gray with red poorly graded sand. These soils are dense to very dense and contain random gravels, cobbles, and boulders. Boulders with dimensions up to 4 feet were encountered, and others in the deposit may be larger. Seismic profiles indicate the sediment deposits in the basin to be underlain by a very dense material (previously interpreted as bedrock). These profiles indicate this very dense material to be below -30 ft MLLW within the basin area, except along its southern boundary. At that location, the very dense material appears to rise rather abruptly to as high as -14 ft MLLW.

2.5 Economic Base

In the mid-1980's, when the idea of a support harbor on St. Paul was developed, most industry and government experts believed that the Americanization of the groundfish and shellfish resources in the Eastern Bering Sea and Aleutian Islands would follow the course of joint-venture operations, in which smaller catcher vessels deliver to larger motherships for processing. The vast area, the lack of shore-based infrastructure, and the availability of capital for large-vessel construction all pointed toward a fadeout of foreign joint-venture operations and an insurgence of U.S. catcher/mothership enterprises. St. Paul was perceived as an ideal location to provide vessel support services (fuel, food, crew changes, gear storage and repair) to this anticipated small-vessel catcher boat fleet.

However, as the U.S. industry took advantage of Government loan guarantees to expand a larger-vessel factory catcher/processor fleet, U.S. investors also developed significant shore-based processing capacity in Dutch Harbor and Akutan Island, often backed by foreign capital. By 1991, it was evident that the industry was overcapitalized, and by 1992, harvesting capacity began to exceed supply and seasons were shortened. By 1995, some bankruptcies had occurred, and many companies were operating at break-even or narrow margins.

Due to its location, St. Paul Harbor offers a unique opportunity to the fishing industry. Three shore-based processors have established themselves in St. Paul to take advantage of its location in the middle of the tanner *opilio* crabbing grounds. A number of floating processors and motherships gather around St. Paul during the crab, pollock, and cod seasons to eliminate the run to Dutch Harbor for catcher vessel support. Several of the smaller catcher/processor trawlers and long-liners have used St. Paul Harbor as a support base during the past 5 years, and larger vessels have expressed an interest if harbor improvements are made. Each operator, whether shore-based or at-sea, is seeking to reduce its costs of operation.

2.6 Problems, Needs, and Opportunities

Construction of the St. Paul harbor was completed in 1990. The harbor was designed to support a fishing fleet one-third the size of the current operating fleet. The harbor was not intended to have any floating or shore-based processing plants. It was designed to accommodate seven unladen, small-class catcher vessels in the harbor at one time for refueling, stocking provisions, and crew changes. Large loaded vessels were not expected to use the harbor because processing facilities were outside the harbor. The design vessel was 110 feet in length and drafted 12 feet unladen.

St. Paul Harbor currently serves a fleet of 230 transient vessels during the crabbing season. According to the mayor, 27 floating processors were within the 3-mile limit in 1994. St. Paul is in a rapid growth cycle, with one permanent onshore processor and two floating processing facilities in the harbor. Unisea moved a floating crab processing plant from Dutch Harbor and moored it between the city docks, and Icicle Seafoods moored a processor next to the local Native corporation dock. Trident Seafoods has built an onshore processing facility. Permanent onshore processing facilities with private supporting facilities are not likely to be constructed until the proposed project is completed.

When more than one vessel in the harbor needs fuel at the same time, waiting can last several hours for access to one of the three fuel docks. During the crabbing season, the fuel docks can be closed a minimum of 3 hours at least once each week when cargo vessels deliver supplies to the harbor. Additionally, the harbor must be closed at random intervals due to weather. Because of the lack of a turning basin, vessels are forced to move to accommodate larger vessels when the harbor is crowded or when large ships are in port. Limited space makes it difficult for vessels to enter and depart the harbor, resulting in substantial delays. An example of this occurred January 12, 1993, when the *M/V Shellfish* tried to depart. Crowded conditions prevented the vessel from swinging out from the dock. Eventually the *Shellfish* had to back out, after waiting more than an hour. At other times vessels must move around to make room for those moving to another dock or departing the harbor.

Large boats and processors operating in the eastern Bering Sea travel to Unalaska (Dutch Harbor) to deliver their catches due to the lack of manuevering room and shallow draft in St. Paul Harbor. Although Dutch Harbor is farther from the fishing grounds than St. Paul, vessel operators are forced to travel there in order to unload their catches. Some operators have said that if the harbor at St. Paul were deeper and had a turning basin, they would choose to unload their product at St. Paul rather than Dutch Harbor to save fuel and travel time.

According to ship operators and the harbormaster, vessels in distress have been towed to Dutch Harbor from the fishing grounds because there was no place for them to tie up at St. Paul without impacting the already congested harbor. Many accidents in the Bering Sea are reported to the Coast Guard during the crabbing and fishing seasons. Most of the injured are taken to the St. Paul Clinic for treatment. Vessels in the harbor are forced to move to allow the entrance of a vessel in distress or a vessel dropping off injured fishermen.

Waves overtopping and passing through the breakwater cause damages to onshore facilities such as roads, utilities, and buildings. This wave energy also damages docks, moorage systems, mobile and fixed equipment, and vessels. During storm events, activities in the harbor must be stopped. In many cases, vessels leave the harbor because of the dangerous conditions. This situation not only causes costs due to repair and cleanup of storm damages, but brings other costs associated with interruptions in servicing vessels and work stoppages at the processing plants. Processing plants will not expand and improve operations until the overtopping is reduced. For example, the *Unisea* has a floating plant that the owners intend to replace with a dock and an onshore plant. However, they have said these plans are not feasible until the overtopping is reduced.

Deeper, wider channels are needed to provide access to larger vessels for shipping processed seafood products efficiently. A larger maneuvering basin is also needed to reduce congestion in the harbor. Vessels need space to leave the docks and turn around to exit the harbor. Increased efficiencies in harbor operations--unloading fish and crab products, servicing vessels, and shipping of processed product--are needed to provide a safer harbor and reduce the potential for accidents. Processing plants cannot accept and process product when shutdowns occur due to wave overtopping and transmission. Vessels have been directed on several occasions to deliver their catches to Dutch Harbor because St. Paul was closed due to storms or because they could not unload their catches there. This situation means increased product deadloss and unused plant capacity at St. Paul.

Also, greater circulation and tidal flushing is needed in the biologically productive Salt Lagoon, adjacent to the harbor. Water exchange between Salt Lagoon and Village Cove before 1988 was maintained by two natural mechanisms. Daily tidal action accounted for approximately 20 percent, by volume, of water exchange in Salt Lagoon. Also, large quantities of water entered Salt Lagoon by overtopping the boulder spit near the natural entrance channel during severe storms. This flooding accounted for an almost complete exchange of water in Salt Lagoon. Although never documented, storms of sufficient magnitude to force water into Salt Lagoon have occurred from 5 to 7 or more times per year.

State and Federal resource agencies strongly opposed the construction of the St. Paul Harbor because of potential impacts to Salt Lagoon through a decrease in water quality. A numerical model for tidal exchange between Village Cove and Salt Lagoon was completed during the earlier General Investigation studies. The results of the model, along with a water quality monitoring program for Salt Lagoon, removed the objection from the agencies, thus permitting the project to be constructed. However, the remnant of a failed breakwater (at the present breakwater alignment) focused the wave energy of a large storm, which shortened and constricted the Salt Lagoon entrance channel, thus decreasing the tidal exchange. The construction of the main and detached breakwaters eliminated this storm-generated water exchange. Marine invertebrate productivity in Salt Lagoon has decreased from pre-project levels because loss of tidal exchange and storm "flushing" has degraded water quality.

3. PLAN FORMULATION

3.1 Planning Objectives

The objectives of this study relate to achieving the National Economic Development (NED) goal of improving the value of goods and services to the Nation. The following are the 50-year study objectives:

- To reduce operating costs of U.S. commercial fishing.
- To reduce costs of transporting processed products to market.
- To reduce damages caused by storm waves overtopping and wave energy transmitting through the existing breakwater at St. Paul.
- To improve safety of vessels operating in the harbor.
- To reduce the potential for vessel accidents, thereby reducing environmental risks.
- To improve water quality in the biologically important Salt Lagoon.

3.2 Planning Criteria

3.2.1 National Economic Development Objective.

The Federal objective of land and water resources planning is to contribute to the National Economic Development (NED) in a way consistent with protecting the Nation's environment. NED features are those that increase the net value of goods and services provided to the economy of the United States as a whole. Only benefits contributing to NED may be claimed for economic justification of the project.

3.2.2 Engineering Criteria.

The selected plan should be adequately sized to accommodate user needs. Adequate depths and size are needed in the entrance channel and maneuvering basin to accommodate the vessels required to meet NED goals. Storm waves overtopping the breakwater and wave energy transmitting through it must be reduced to a level that does not restrict harbor activities (either in the water or on shore) and does not compromise human safety. The plan must also be feasible from an engineering standpoint and capable of being economically constructed.

3.2.3 Economic Criteria.

The economic evaluation of alternative plans is on the common basis of current prices, a project life of 50 years, and an interest (discount) rate of 7-5/8 percent. Plan development must be such that benefits exceed project costs to the maximum extent possible. The benefits claimed must be capable of being expressed in terms of constant time and value of money, and they must exceed the equivalent economic costs of the project.

3.2.4 Environmental Criteria.

Environmental criteria include identification of aquatic life and wildlife that might be impacted by implementation of the plan, minimizing the disruption of the area's natural resources, maintaining consistency with the Alaska Coastal Management Plan, and protecting or enhancing existing environmental values, including water quality in the Salt Lagoon.

3.2.5 Social Criteria.

Plans considered must minimize adverse social impacts and must also maintain consistency with State, regional, and local land use plans, both public and private. The plan must be acceptable to the local sponsor.

3.3 Alternatives Considered

3.3.1 No Action.

This alternative does not meet the existing or future needs of St. Paul. Vessels would continue to move to accommodate larger vessels when the harbor is crowded or when large ships are in port. Substantial delays would continue because of the limited space, making it difficult for vessels to enter and depart the harbor. Vessels would continue to move away from docks so larger vessels can transit the harbor. Large boats and processors operating in the eastern Bering Sea would continue to deliver their catches to Unalaska (Dutch Harbor) due to the shallow draft and lack of maneuvering room in St. Paul Harbor. Vessels in distress would continue to be towed to Unalaska from the fishing grounds because there would be no place for them to tie up at St. Paul without impacting the congested harbor. Vessels in the harbor would continue to move to allow the entrance of vessels in distress or dropping off injured crew. Transportation costs for processed seafood products would not decrease due to the economic advantages of using larger vessels. The water quality and productivity of Salt Lagoon would continue to degrade.

3.3.2 Tolstoi Point Breakwater.

In this plan, a breakwater would be constructed north of Boulder Spit, extending south toward the existing main breakwater. An entrance channel would be dredged between the existing main breakwater and the new breakwater. This would, in effect, create a new harbor separated from the existing harbor by the existing detached breakwater. New docks would have to be constructed along Boulder Spit and channels dredged to provide dock access. Also, access roads and utilities would be constructed across Boulder Spit. This breakwater would cost in excess of $40 million, plus the cost for dredging, docks, access, and utilities. It would be larger than the existing breakwater that cost $25 million. Environmentally, this alternative is unacceptable for three reasons: (1) The site, Tolstoi Point, is USFWS refuge land and a shorebird habitat area; (2) the plan would reduce wave energy into the Salt Lagoon; and (3) the plan would require access across Boulder Spit. Salt Lagoon and Boulder Spit are important wildlife resources unique to the Bering Sea.

3.3.3 Relocation of Detached Breakwater.

This plan would require demolishing the existing detached breakwater and reconstructing a new, larger breakwater, thereby expanding the size of the existing harbor. The new breakwater would require larger rock than that in the existing breakwater. The plan would have dock, dredging, access, utility, and environmental requirements similar to those of the Tolstoi Point Breakwater plan. This alternative is unacceptable for the same cost and environmental reasons.

3.3.4 Dredging Salt Lagoon.

A harbor in Salt Lagoon would require a large entrance channel, which would be built across Boulder Spit or by enlarging the existing Salt Lagoon channel. Access channels would have to be dredged, docks built, and utilities provided. The entrance channel would be excavated and dredged from existing elevations of up to +20 ft MLLW to a final elevation of -30 ft MLLW. Access channels would be dredged from existing levels of -2 ft MLLW to final depths of -29 ft MLLW. The massive quantities of dredged material and the new docks would make this a very expensive alternative. Moreover, a harbor in Salt Lagoon is environmentally unacceptable because Salt

Lagoon and Boulder Spit are important wildlife resources unique to the Bering Sea. Access across Boulder Spit would not be allowed by the resource agencies, and the existing Salt Lagoon channel is considered the most productive part of the ecosystem. Further degradation of the Salt Lagoon is not acceptable to the environmental community.

3.3.5 Harbor Modifications.

Harbor modifications become the only economically and environmentally acceptable improvements for the St. Paul Harbor. Existing breakwater, channel, and dock configurations constrain the alternatives available. With these constraints in mind, several alternatives were evaluated and are described in the next subsection.

3.4 Modification Elements Considered in Detail

3.4.1 Entrance Channel Deepening.

The entrance channel must be deepened to allow access for larger vessels. It must be oriented to allow vessels to head into the wind and waves as soon as they clear the breakwater, yet minimize the time a vessel is broadsided by wind and waves when approaching the harbor entrance. A deeper entrance channel is naturally constrained between the main breakwater, the existing docks, and the detached breakwater. The detached breakwater cannot be reduced in length because this would increase the wave heights in the harbor. The width of the deepened entrance channel (at the channel bottom) is constrained by the 150-ft opening between the breakwaters. A channel 150 feet wide would allow one-way traffic for the design vessel.

3.4.2 Maneuvering Basin.

The maneuvering basin would extend from the entrance channel to the south end of the city south dock. Docks south of the city south dock are privately owned by Tanadgusix Corporation (TDX), the local Native corporation. Harbor improvements adjacent to the TDX dock and a locally proposed small boat harbor are not part of this project. Deeper dredging would not extend up to the city north dock due to the possibility of impacting pile foundations. The city south dock, a concrete caisson structure, would have sheet pile installed along the face and part of the sides to prevent undercutting of the dock foundation due to dredging. Sheet pile is allowed only because the existing dock already has a flat, wave-reflective surface; adding sheet pile would not change the existing wave climate.

3.4.3 Spending Beach.

Deepening the entrance channel and maneuvering basin would result in increased wave action in the harbor and at the existing docks. Therefore, a spending beach was considered, to be located inside the harbor adjacent to the detached breakwater. The spending beach would be in a low circulation zone and would not change the existing currents. The spending beach would reduce the wave climate to slightly below existing conditions.

Wave reduction due to the spending beach would occur along the city docks inside the main breakwater, at the TDX dock south of the city docks, and at the site of a locally proposed small boat harbor. The spending beach would also be designed to create a gyre adjacent to Boulder Spit. This gyre would allow sediment moving along Boulder Spit and entering the harbor at the detached breakwater to drop out before it reaches the main harbor area. Reduction in sediment moving into the main harbor area would benefit all harbor facilities, including the city docks, the TDX docks, and the locally proposed small boat harbor.

The originally proposed mooring area, where the mooring dolphins were to be located, is the location of the spending beach. Due to the changes in harbor operations since initial design and construction, the mooring dolphins described in the authorized project are no longer a project requirement. These mooring dolphins were proposed to handle seven 110-ft vessels being moved off the docks in the event of a large storm closing the harbor. In 5 years of operation, very few vessels have been forced to remain in the harbor during storms. Of those that have, many were over the 110-ft length and could not have used the mooring dolphins anyway. Vessels have been able to remain at the south dock and the TDX dock during the most violent storms. These two docks can handle from four to seven vessels, depending on their lengths.

Nine hundred feet of dock space was required under the original project authorization. The city has 300 ft of dock, TDX has 300 ft, and the *Unisea* processor provides 400 ft, for a total of 1,000 ft of dock space currently in the harbor. The majority of the proposed maneuvering basin area would have wave heights under 2.5 ft during storms and could be used for temporary moorage when the docks are not available.

3.4.4 Measures to Reduce Waves.

Green water and wind-driven spray overtop the existing breakwater many times each year. This situation impacts current shore-based and moored harbor operations. Space on the lee of the breakwater is needed for harbor efficiency and expansion. The breakwater was designed for minimal overtopping; during construction, large cap stone was added to further reduce overtopping. However, observations and local experience since breakwater completion indicate more frequent and more severe overtopping than intended. Model studies indicate that in addition to overtopping, a significant amount of wave energy is being transmitted through the breakwater.

Several solutions to reduce overtopping and the transmission of wave energy through the breakwater were modeled, including breakwater overlay, toe berm, and offshore reefs.

3.4.5 Wave Energy Channel for Salt Lagoon.

Water exchange between Salt Lagoon and Village Cove before 1988 was maintained by two natural mechanisms. Daily tidal action accounted for approximately 20 percent, by volume, of water exchange in Salt Lagoon. Also, large quantities of water entered Salt Lagoon by overtopping the boulder spit near the natural entrance channel during severe storms. This flooding accounted for an almost complete exchange of water in Salt Lagoon. Although never documented, storms of sufficient magnitude to force water into Salt Lagoon occur from five to seven or more times per year.

The construction of the main and detached breakwaters eliminated storm-generated water inflow into the lagoon. Marine invertebrate productivity in Salt Lagoon has decreased from pre-project levels because loss of tidal exchange and storm "flushing" has degraded the water quality. This adversely impacts the huge concentrations of sea birds that draw tourists from around the world.

This problem could be mitigated by means of a wave energy channel. The wave energy channel would allow large quantities of water into Salt Lagoon from outside St. Paul Harbor. Storm water from the Bering Sea would enter Salt Lagoon through the wave energy channel and exit through the natural entrance channel. This would ensure that nonpolluted water (water that has not entered Salt Lagoon through the boat harbor) would flush Salt Lagoon periodically. The storm-induced water exchange would cleanse Salt Lagoon.

4. OPTIMIZATION OF HARBOR FEATURES

4.1 Harbor Design Criteria

4.1.1 Authorized Project Design Criteria.

It was originally anticipated that St. Paul Harbor would be used as a service port by fishing vessels delivering their catch to floating processors, similar to the pattern in use by foreign fleets and by the joint-venture operation in existence when the project was being formulated. Consequently, the design vessel used was 110 feet in length with a 35-ft beam and an unloaded draft of 12 ft. (It was assumed that vessels would be unloaded when entering the harbor; loaded drafts would have been on the order of 16 to 18 feet). Dock space was to be provided for seven 110-ft vessels.

A maximum navigable wave height of 9.8 ft was to control harbor ingress and egress. Waves of this height have average velocities ranging from 2.0 to 4.5 knots. The 90-degree turn into the harbor requires vessels to slow from their average speed of 10 knots down to 1 to 2 knots; at seas above 9.8 ft they could lose rudder control.

The entrance channel design criteria for the authorized project are shown in table 2 in the next subsection. The vessel motion criteria (pitch, roll and heave) are taken as two-thirds of the maximum navigable wave (9.8 ft).

The maximum allowable wave height at moorage areas within the harbor was set at 2.5 feet to satisfy the safe harbor criteria. The design vessels are larger than 100 feet, which is the largest design vessel in small boat harbors, and they operate in the Bering Sea area under very rough conditions. Therefore, the design wave height was relaxed from the customary 1 foot for berthing areas and 2 feet for anchorage areas.

4.1.2 Revised Design Criteria.

An independent evaluation conducted by Natural Resources Consultants, Inc., identified several new design criteria that were used for the 1995 study. A design vessel with a length of 325 feet, beam of 50 feet, and loaded draft of 23 feet was determined. This ship would be a refrigerated cargo vessel or a medium-size factory trawler. To accommodate this larger vessel, a deeper entrance channel and maneuvering basin inside the harbor are required. The proposed entrance channel depth was determined based on the revised criteria shown in table 2.

TABLE 2.--*Harbor design criteria*

	Authorized	Revised
Design vessel length (ft)	110	325
Entrance channel bottom elev. (ft MLLW)	-18	-30.0
Design vessel draft (ft)	12	23
Tide (ft MLLW)	-2.5	0.5
Ship motion - wave (ft)	6.5	4.4
Squat (ft)	0.3	0.6
Safety clearance (ft)	2	2
	Accessibility	
	Waves (%)	73.5
	Tide (%)	90
	Total (%)	66
	Days per month	20

These criteria and channel optimization result in an entrance channel depth of 30 ft at MLLW. The natural elevation out to approximately 500 ft offshore from the end of the breakwater was surveyed and determined to be -26 ft MLLW. The proposed channel would be dredged to -30 ft MLLW with an additional 2 ft for advance maintenance, reaching natural depths of -32 ft MLLW about 1,200 ft offshore from the breakwater. It was assumed that tug assists would guide the design vessel through the entrance channel and into the harbor.

Channel width was determined by criteria given in EM 1110-2-1613, "Hydraulic Design of Deep-Draft Navigation Projects." For a one-way ship channel with 1.5- to 3-knot currents, the width should be 3.5 to 4 times the beam of the design vessel, which would result in a channel width of 175 to 200 ft. Due to the severe wave action, high wind velocities, and poor visibility at St. Paul, a channel bottom width of 250 ft is required. An additional 25 feet (0.5 times the beam) is required for the 90-degree curve (radius of 275 ft) in the channel into the harbor. The entrance is restricted in the area between the detached breakwater and the north city dock. A bottom width of 150 feet in this area, with side slopes of 1V:3H, would allow for 10-ft benches on each side adjacent to the breakwater.

4.1.3 Design Wave.

As a result of video monitoring of the completed project, it was determined that the design wave height and period and still water level may have been underestimated during the 1987 study. Indications are that wave periods of 16 to 20 seconds are occurring at St. Paul, significantly higher than previously estimated. Video footage also indicated that wave energy was being transmitted through the breakwater; a direct correlation was noted between motion of the *Unisea* floating processor and the period of waves hitting and overtopping the breakwater.

Still water levels were also believed to be underestimated in the earlier studies; videotape and observations suggest that storm surge, wave setup, and/or barometric pressure effects may increase still water levels during storms to +7.0 ft MLLW and possibly even +9.0 ft MLLW. Since the original estimate was +5.0 ft MLLW, this additional few feet of elevation could contribute to the overtopping that occurs frequently at the site during storms.

Based on analysis of videotapes and harbor users' observations, the current analysis used an estimated design wave height of 28 feet and a design wave period of 20 seconds. This wave would be a depth-limited wave for a still water level of +7.0 feet. This design storm event is believed to occur every fall at St. Paul Island.

4.1.4 Channel Depth Optimization.

A channel depth optimization analysis was done to evaluate the effects of tides and waves on harbor ingress and egress for the design vessel.

The analysis is based on the following assumptions:

a. Although tide is a predictable limiting factor, the prediction of wave height effects on harbor access can be only approximated from seasonal trends. During the winter and fall commercial crabbing season, it would be difficult to plan design vessel access to the harbor more than 1 or 2 days ahead of time if wave height is the predominant factor.

b. The at-sea operational cost of the design vessel is $634 per hour. (This estimate is based on a foreign freighter similar in size and mode of operation to the design vessel.)

During the tanner *opilio* crab season in January through March, the weather near St. Paul Island is highly variable. Conditions can change markedly in just a few hours. This creates difficulty in scheduling vessels into and out of the harbor. As indicated by the percent utilization table (table A-13 in appendix A) for different entrance channel depths, the deeper the channel the less effect wave height and tide have on the percentage of days the design vessel can use the harbor. At a channel depth of 28 ft at MLLW, on the average the design vessel could enter the harbor 3.3 percent of the time, or have a 1 in 30 chance of gaining access on its scheduled day. In any 30-day period, the vessel would be able to gain access on only 1 day. When the channel is deepened to 29 ft, the effect of tidal change is diminished, and the design vessel can gain access 13 out of 30 days, or approximately 43 percent of the time.

Cargo vessels are expected to pick up seafood product at St. Paul 18 times each season. The design vessel incurs operational costs of $15,200 per day. For each day the design vessel cannot gain access to the harbor, it incurs additional costs. Table 3 and figure 3 present the expected net benefits associated with different channel depths and the resulting usage rates.

TABLE 3.--*Harbor depth optimization analysis*

	Channel bottom elevation (ft MLLW)			
Item	**-32**	**-31**	**-30**	**-29**
Days of utilization/month	21	21	20	13
Probability of access on day scheduled	0.70	0.70	0.67	0.43
Possible number of hours' delay per entrance & exit	7.20	7.20	8.00	13.60
Vessel delay: Hours delay × $634/h × 18 delays/entrance & exit	$82,166	$82,166	$82,166	$82,166
Average annual benefits of 100% channel access	$2,613,000	$2,613,000	$2,613,000	$2,613,000
Average annual benefits (100% access less total cost of delay per season)	$2,530,834	$2,530,834	$2,521,704	$2,457,797
Average annual cost*	$1,476,215	$1,444,060	$1,411,906	$1,384,574
Average annual operation & maintenance cost*	100,000	100,000	100,000	100,000
Total average annual cost	$1,576,215	$1,544,060	$1,511,906	$1,484,574
Net NED benefits for channel optimization	**$954,619**	**$986,774**	**$1,009,798**	**$973,223**

* 50-yr period @ 7-5/8%.

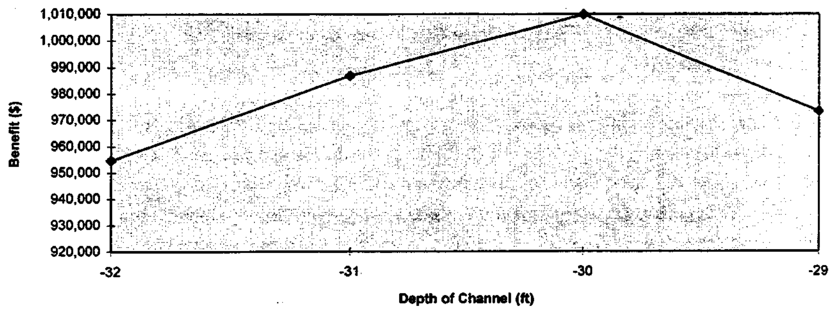


FIGURE 3.--Net NED benefits for channel optimization at various channel depths.

4.1.5 Maneuvering Basin.

A 415-ft-by-830-ft maneuvering basin inside the harbor is required for the proposed design vessel to turn around and dock. The channel is elongated to allow for drift that could occur due to currents in the harbor. Width was determined by the design vessel length times 1.5 for turning. The depth for the maneuvering basin is 29 ft at MLLW. This is based on a 23-ft-draft vessel, one-half the maximum wave height of 2.5 ft in the harbor, a 2-ft safety clearance for a sand bottom, and a minimum low-tide elevation of -2.5 ft MLLW.

4.2 Model Studies

Constructing and analyzing a physical model is one of the most efficient and accurate methods of investigating the physical characteristics of coastal processes. Two-dimensional (2-D) and three-dimensional (3-D) model studies at the Waterways Experiment Station (WES) in Vicksburg, Mississippi, were used extensively in the design of the original project. Additional model studies were conducted at WES to optimize the harbor modifications proposed in this study. These modifications are intended to reduce damage to the road and harbor facilities due to wave transmission and overtopping on the harbor side of the breakwater, and to widen and deepen the entrance channel to allow deeper-draft and longer vessels to use the harbor.

A 2-D flume test was conducted to develop methods of reducing wave overtopping and energy transfer through the existing breakwater. The model was then used to select the best solution. This optimization included analysis of offshore reef cross sections for their stability and effectiveness. A 3-D harbor model was then used to check the relative differences in harbor wave action, currents, and sedimentation between existing conditions and proposed changes.

4.2.1 Two-Dimensional (2-D) Study.

The objectives of the 2-D model study were to:

- Confirm the relative increase in overtopping of the prototype breakwater by simulating the existing cross-section and wave conditions by using previous water levels and wave periods versus new water levels and wave periods.

- Test the various alternatives under the wave conditions expected, to optimize a proposed cross section which would result in minimal overtopping and energy transmission through the breakwater.

- Conduct stability tests to determine the stone size necessary for construction of a selected alternative.

- Investigate the level of possible wave energy transmission through the breakwater and reduce the level, if it is high enough to cause adverse ship motion in the lee of the breakwater.

A 2-D model at a scale of 1:38.5 was used to achieve these objectives. Once the as-built cross section of the breakwater (existing condition) was modeled and results verified, several proposed alternatives were set up and run. Test runs were made to analyze several toe berm configurations and several variations on an offshore reef. The most effective alternatives were the one-reef and three-reef plans. These plans, summarized below, are discussed in more detail in Appendix A, Hydraulic Design.

The single-reef alternatives were generally not as effective as the three-reef alternatives, though they were effective in reducing wave overtopping. There was considerable variability in effectiveness with respect to wave period, depending on the distance offshore to the reef and the crest width of the reef. The longer the distance to the reef, the greater the reduction in overtopping. Crest elevation was also an important factor in reducing overtopping.

The three-reef alternatives were most effective in reducing overtopping. The reefs with crest elevations of -8.0 ft MLLW were more effective than those at -10.0 ft MLLW and -12.0 ft MLLW, but not significantly so. While wave overtopping effectiveness did vary with wave period, in general the average reduction in overtopping for 16-second waves was 94 percent and for 20-second waves was 97 percent for the three-reef alternatives with SWL's (still water levels) of +7.0 feet.

Table 4 summarizes the most effective alternatives and provides a means of selecting the preferred plan. Based on wave overtopping rate reduction, relative quantities, and wave heights relative to the reef(s), Plan 2I (three reefs at -12 ft MLLW crest elevation) was selected as the most effective and economical. Plan 2I has three parallel reefs starting at 170 feet offshore from the existing breakwater, with each reef separated from the others by 70 feet. Each reef has a crest width of 20 feet, crest elevation of -12 ft MLLW, and side slopes of 1:1.5. Stone size ranges from 0.5-ton to 6-ton. The stone would be placed by barge dumping.

TABLE 4.--*Two-dimensional model study: overtopping in the most effective plans (cfs/ft)*[a]

Plan	Period (seconds)				Estimated quantities of material in reefs (cubic yards)[b]
	11	14	16	20	
1C[c]	0.81	1.22	1.38	1.48	0
2B	0.03	0.02	0.05	0.03	111,000
2E	0.04	0.01	0.05	0.05	95,000
2H	0.07	0.04	0.10	0.06	84,000
2T	0.15	0.06	0.13	0.51	82,200
2I	0.10	0.05	0.12	0.08	70,400
2U	0.12	0.06	0.18	0.48	71,500

[a] Worst overtopping measured in each period group.
[b] Reefs are 900 linear feet in length.
[c] Existing conditions.

4.2.2 Three-Dimensional (3-D) Study.

A 3-D hydraulic model was constructed for the following purposes:

- Study wave and shoaling conditions for the existing harbor.

- Determine the most economical breakwater modifications that would provide adequate wave overtopping protection to the harbor.

- Provide qualitative information on the effects of the breakwater modifications and entrance channel dredging on sediment movement adjacent to the harbor and shoreline of Village Cove.

- Evaluate the effects of breakwater modifications and harbor and entrance channel dredging on wave heights in the harbor.

- Develop remedial plans, if required, to alleviate undesirable conditions.

The 3-D model was a fixed-bed, undistorted 1:100 scale model. The fixed-bed model reproduced about 13,500 feet of the St. Paul Island shoreline and included the existing harbor located in Village Cove. It also included underwater topography in the Bering Sea to a prototype offshore depth of 36 ft at MLLW, with a sloping transition to a prototype elevation of -60 ft MLLW. A small connecting channel to Salt Lagoon (located northeast of the harbor) and the tidal prism of Salt Lagoon were included in the model. The model represented about 3.2 square miles of the prototype.

4.2.3 Model Study Results.

Model tests were run for the existing condition, a single offshore reef system, and several variations with three offshore reefs. The tests of the three offshore reefs differed by reef lengths and by spending beach locations and geometry. The most effective plan in reducing wave heights and providing a sediment trap for incoming bedload sediments to the harbor was plan 2I. This plan includes three reefs, each 1,300 ft in length, and a spending beach. The spending beach has side slopes of 1V:10H from elevation -5 ft to 0 ft MLLW, 1V:5H from 0 ft to +12 ft MLLW on the east side, and 1V:5H from -5 ft to +12 ft MLLW on the west side. Wave height ranged from 2.2 ft for a 16-second wave to 2.1 ft for a 20-second wave at the TDX dock. Similarly, wave heights at the proposed small boat harbor ranged from 1.7 ft to 1.6 ft. Such wave heights were significantly reduced by altering the geometry of the spending beach "island" until arriving at this final plan. The same layout with three offshore reefs 1,200 feet in length was also modeled, with similar wave heights.

Current Velocity. Model studies indicated that currents in Village Cove moved clockwise for test waves from the west. The currents moved south along Boulder Spit and seaward adjacent to the head of the breakwater. In some cases, a small counterclockwise eddy occurred west of the entrance of the channel connecting Salt Lagoon.

Sedimentation. Photos taken during the model study indicated that sediment transport patterns in the harbor for each test series were similar for all wave periods and heights. Sediment in the eastern portion of the cove migrated south along Boulder Spit toward the Salt Lagoon entrance. Sediment adjacent to the dock and breakwater head moved in a clockwise eddy in that vicinity for the larger test waves. The 3-D model results closely correlated with sedimentation patterns observed during a June 1995 survey. That survey found a -32-ft-MLLW scour hole off the head of the existing breakwater structure and sediment deposition near the proposed small boat harbor area and in front of the Salt Lagoon entrance.

5. DESCRIPTION OF RECOMMENDED PLAN (HARBOR IMPROVEMENTS)

5.1 Plan Components

The recommended plan, referred to as plan 11 in the 3-D model study and plan 2I in the 2-D study, has the following components: a dredged entrance channel at -30 ft MLLW with an additional 2 ft for advance maintenance; a maneuvering basin at -29 ft MLLW; a spending beach on the lee side of the detached breakwater; and three offshore reefs parallel to the main breakwater, each 1,300 ft long, at a depth of -12 ft MLLW. A plan view is shown in figure 4. A wave energy channel 100 ft wide as mitigation to increase the flow of water into Salt Lagoon would be constructed at the same time and monitored by the Corps and resource agencies. This Salt Lagoon mitigation is discussed in section 6.

5.1.1. Entrance Channel Deepening.

The entrance channel is constrained between the detached breakwater and the city north dock to a bottom width of 150 ft. The channel as designed would allow one-way traffic for the design vessel. This vessel is 325 ft long, 50 ft wide, and drafts 23 ft fully loaded. The design vessel would be able to enter and exit the harbor when tides are +0.5 MLLW or higher and waves are 6.6 feet or less.

The entrance channel would come in perpendicular to the main breakwater starting about 1,200 feet offshore and make a 90-degree right turn around the head of the main breakwater to enter the harbor between the main breakwater and the detached breakwater. The entrance channel would be 250 feet wide in the approach and up to 350 feet wide in the 90-degree turn. The channel width would decrease to 150 feet to enter the harbor. The channel center line radius through the turn is about 275 feet.

Channel elevation is -30 ft MLLW through the approach, through the turn, and between the main and detached breakwaters. Once clear of the detached breakwater, the entrance channel transitions to the maneuvering basin with a elevation of -29 ft MLLW. Ten-foot-wide benches would be left adjacent to the breakwaters to protect the breakwater foundations. Side slopes would be 1V:3H.

Two feet of advance maintenance dredging would be accomplished during the initial construction. Advance maintenance dredging would bring the initial channel elevation to -32 ft MLLW.

5.1.2 Maneuvering Basin.

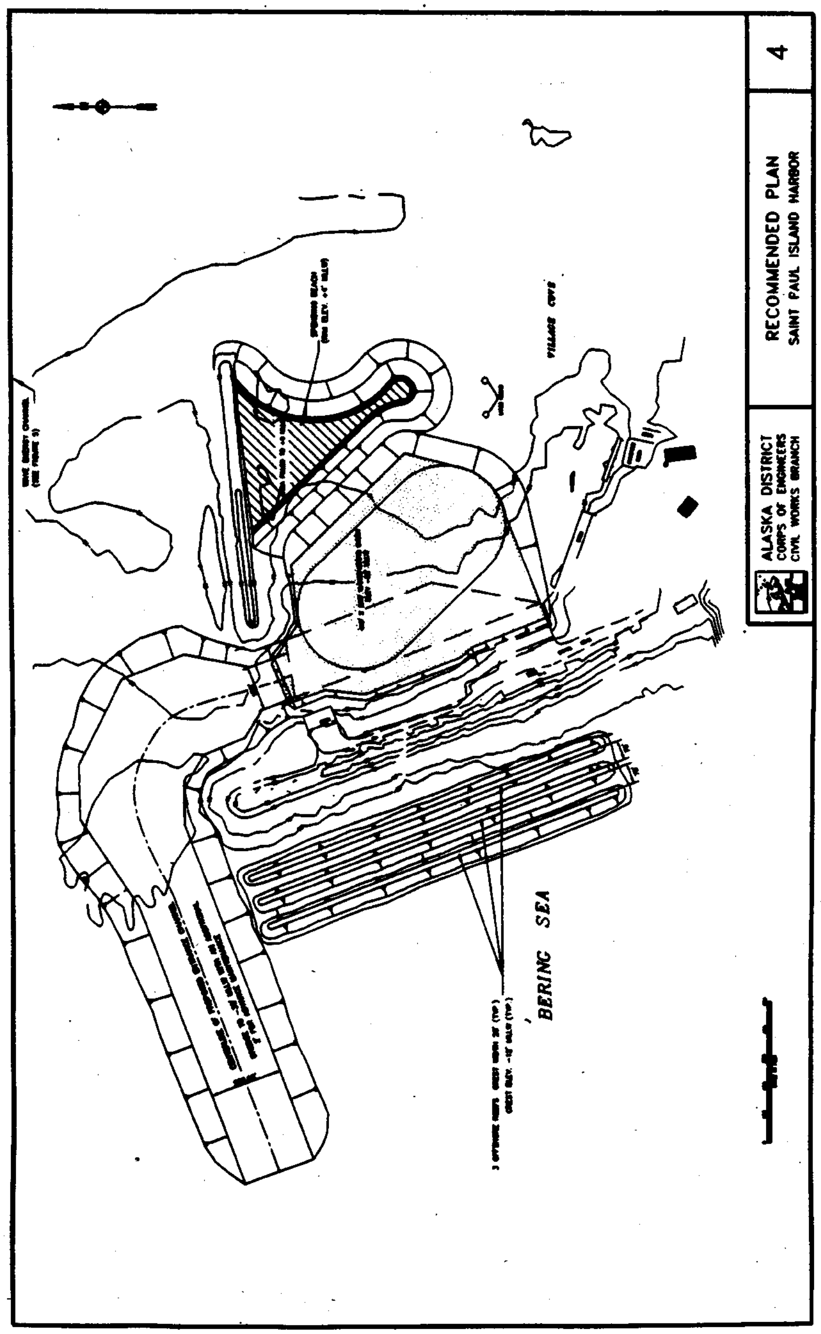
A 415-ft-by-830-ft maneuvering basin would be dredged to a depth of -29 ft MLLW to allow the design vessel to turn while approaching and leaving the city south dock in the harbor. This depth would allow the design vessel to remain in the harbor regardless of tide level to complete its cargo loading operations. Also, the maneuvering area could be used for temporary mooring of vessels displaced from the dock while the freighters are being loaded, or for the design vessel, should storms keep it in the harbor.

Basin side slopes would be 1V:3H except at the city south dock, where they would be vertical. A 10-ft-wide bench would be left in place adjacent to the city north dock to protect the pile foundation. The existing caisson dock (city south dock) at the southwest corner of the manuevering basin would have sheet pile installed along the face and part of the sides to prevent undercutting the dock foundation.

The maneuvering basin would begin at the entrance to the harbor adjacent to the city north dock and the detached breakwater, and continue south even with the city south dock. The TDX docks are located south of the city south dock. Dredging would not be done adjacent to the TDX docks, which are privately owned.

5.1.3 Spending Beach.

The spending beach would be constructed of material dredged from the maneuvering basin and armored with stone from -5 ft up to +4 ft MLLW. It would abut the lee side of the detached breakwater and would have a crest elevation of +4 ft MLLW at its rim. The area inside the outer rim would have an elevation of 0 ft MLLW. Side slopes on the eastern shore would be 1V:10H from -5 ft to 0 ft MLLW, armored with 200-lb stone, and 1V:5H from 0 ft to +4 ft MLLW, armored with 1,000-lb stone. On the western shore of the spending beach, side slopes would be 1V:5H, with armor from -5 ft to +4 ft MLLW. The back slopes into the center of the spending beach would be at the angle of repose (1V:1.5H) , with armor down to the fill elevation of 0 ft MLLW. Crest width along the rim would be approximately 9 feet.


BERING SEA
VILLAGE COVE
ALASKA DISTRICT
CORPS OF ENGINEERS
CIVIL WORKS BRANCH
RECOMMENDED PLAN
SAINT PAUL ISLAND HARBOR
4

5.1.4 Offshore Reefs.

The three reefs would be constructed offshore, parallel to the main breakwater, along the -28 ft MLLW contour. The reef ends would be aligned with the head of the main breakwater and extend along the breakwater. The reefs would be constructed on a 3-ft layer of 20- to 500-lb bedding stone. The reefs would be constructed of 1,000- to 8,000-lb (0.5- to 4-ton) quarry run stone. The inner reef would be 170 ft from the toe of the breakwater. Reefs would be 70 ft apart measured to the adjacent crest; the crest width of each reef would be 20 ft. Side slopes would be 1V:1.5H. The bedding layer would be continuous between reefs, extending 20 ft beyond the toe of the two outside reefs.

5.2 Plan Benefits

The proposed improvements to the St. Paul Harbor would provide benefits in the following categories: breakwater overtopping, transportation savings, reduction in crab deadloss, prevention of vessel loss, and operation and maintenance savings. Benefits of the recommended plan are presented in table 5. The details of the benefit calculations are in appendix B. The total average annual benefits are estimated at $2,613,000. Net annual benefits (annual benefits less annual costs) are $1,047,000, and the benefit/cost ratio is 1.7.

TABLE 5.--*Summary of benefits*

Category	Amount
Prevention of damage from breakwater overtopping	$525,000
Savings in transportation of processed seafood	1,370,000
Reduction in crab deadloss	159,000
Prevention of vessel loss due to unsafe harbor conditions	86,000
Saving of expenses caused by vessel diversions to Dutch Harbor[a]	55,000
Operation and maintenance savings	418,000
Total annual benefits	$2,613,000

[a] $5,000 of this amount is for vessels harvesting Russian crab.

While not ideal, the existing docks and infrastructure are adequate to service the design vessel, and additional dock space or crane capacity is not required to realize project benefits. The existing city south dock is a 200-ft-long caisson design and is considered a heavy-load dock. The design vessel would overhang the dock in order to tie up to it. Currently, full containers are hauled to the dock and moved to the vessels with large lift truck-type equipment. The design vessels expected to call on St. Paul would have onboard cranes.

The inner harbor improvements, the deeper entrance channel and maneuvering basin, the spending beach, and the three offshore reefs that reduce wave overtopping and wave energy transmission through the breakwater during storms are not separable elements. The whole project is based on improving safety, reducing damages caused by storm action, and improving efficiencies in harbor operations.

5.3 Plan Costs

Table 6 presents the detailed estimated costs of the recommended plan for harbor improvements, based on October 1995 price levels. The estimated annual operation and maintenance costs are summarized in table 7.

5.4 Risk and Uncertainty

As in any planning process, some of the assumptions made in this report are subject to error. Elements of risk and uncertainty could affect the harbor design, costs, and/or benefits. These elements are discussed in the pertinent portions of the report and appendixes.

Table 8 shows how much of an increase in certain costs or quantities, or how much of a decrease in benefits, could be tolerated for the project to maintain economic feasibility (benefit/cost ratio of 1.0 or greater). Each factor shown is adjusted to the limit of project feasibility, while all others are kept at the values assumed elsewhere in this report. This analysis supports the soundness of project feasibility.

5.5 Construction Considerations

Major construction items include the offshore reefs, spending beach, dredging, and Salt Lagoon mitigation. The Salt Lagoon mitigation (wave energy channel) would be built first and is discussed in section 6. The reefs would be built second. After the reefs are completed, work on the dock(s) and/or dredging could be started. The spending beach (used as a disposal for a portion of the dredged material) would be

TABLE 6.--*Detailed cost estimate for harbor improvements, St. Paul, Alaska (October 1995 price level)*

Item	Qty.	Unit	Unit price ($)	Contingency	Shared NED costs ($000)[a] Federal	Local	TOTAL
General Navigation Features							
Mobilization & demob.	1	LS	479,000	20%	374	201	575
Offshore reefs							
Quarry access fee	1	LS	80,000	10%	57	31	88
Bedding stone	42,000	yd^3	25.20	10%	757	407	1,164
Armor stone	75,000	yd^3	36.84	10%	1,975	1,064	3,039
Hydrographic surveys	2	ea	43,925	10%	63	34	97
Reef dolphins (cluster of 3)	2	ea	63,293	10%	90	49	139
SUBTOTAL					2,942	1,585	4,527
Dredging							
Entrance channel	90,000	yd^3	23.42	20%	1,645	885	2,530
Channel advance maint.	40,000	yd^3	20.90	20%	1,003		1,003
Maneuvering basin (<20')	120,000	yd^3	24.38	20%	2,809	702	3,511
Maneuvering basin (≥20')	60,000	yd^3	24.38	20%	1,141	615	1,756
Spending beach stone	18,000	yd^3	38.98	20%	547	295	842
Hydrographic survey	2	ea	43,925	20%	69	37	106
SUBTOTAL					7,214	2,534	9,748
Mooring basin							
Dredge mooring area	40,000	yd^3	22.47	20%		1,079	1,079
Sheet pile protection	265	tons	1,583	20%		503	503
SUBTOTAL						1,582	1,582
CONSTRUCTION CONTRACTS					10,530	5,902	16,432
Engineering and design	1	LS	675,000	10%	457	285	742
Construction management	1	LS	771,000	10%	526	322	848
Subtotal General Navigation Features					**11,513**	**6,509**	**18,022**
Lands and damages							
Acquisitions	7	acres	2,291	6%		17	17
Administrative cost	1	LS	8,000	6%		8	8
SUBTOTAL						25	25
TOTAL PROJECT COST					**11,513**	**6,534**	**18,047**

[a] Features showing Federal costs are General Navigation Features. These can be paid in part by the Federal Government, subject to current cost-sharing laws and the Federal cost limit.

TABLE 7.--*Annual NED costs of operation, maintenance, and replacement (OM&R), recommended plan*

Item	Interval	EQUIVALENT ANNUAL COSTS ($) Corps	Local	Total
Channel dredging (approx. 40,000 yd^3)	10 yr	92,000		92,000
Offshore reefs (approx. 2,700 yd^3 replaced)	10 yr	7,000		7,000
Spending beach (approx. 1,000 yd^3 replaced)	20 yr	1,000		1,000
TOTAL OM&R COSTS		$100,000	$ ---	$100,000

TABLE 8.--*Sensitivity analysis of project economic feasibility using selected factors*

Factor	Original value	Maximum change to retain 1.0 BCR Value	Percent	New value
Total annual benefits	$2,613,000	-1,047,000	-40%	$1,566,000
Total NED construction cost	$18,047,000	+15,353,000	85%	$33,400,000

constructed last. The time needed for construction, including Salt Lagoon mitigation, is estimated at 12 months.

The offshore reefs would be constructed by dumping rock from a dump scow or barge. The alignment of the reefs could easily be controlled from ranges set up on shore and/or on the existing breakwater. Side slopes of 1V:1.5H represent the angle of repose of dumped material. A plus tolerance for crest elevations could be written into the project specifications to allow for 2 ft of rock placement above the specified -12 ft MLLW, while holding the -12 ft MLLW as the minimum required depth. Stone would be hauled by truck to the city dock, loaded onto barges, and then placed, assuming that the contractor selects the quarry on the island as his rock source.

Initial construction of the entrance channel would involve dredging material consisting of approximately 50 percent sand and 50 percent boulders to the project limits.

Disposal would be at the new city landfill, a 7.7-mile haul distance, and in the spending beach island on the south side of the detached breakwater.

5.6 Plan Accomplishments

5.6.1 Economic Efficiency.

The economic efficiency of proposed modifications to St. Paul Harbor cannot be properly evaluated without recognizing the interconnectedness of cargo transport and understanding how current trends in cargo transport will affect the future competitive position of the port. These matters are further discussed in appendix B. One of the most important of these trends concerns economies of scale as they affect cargo transportation.

Obvious economies of scale are driving carriers to ever larger vessel sizes. In general, the more materials a given cargo vessel can carry on any given transit between two ports, the more net profit that carrier can enjoy. A vessel that has 3.5 times the cargo capacity of another has only double the daily fixed costs. This trend toward larger cargo vessels is particularly relevent to St. Paul. Being phased into service over the next 5 years are vessels in the 300- to 350-ft Length Overall (LOA), 150,000-cubic foot (ft^2) and larger cargo classes. Similar trends are evident in the small container vessel fleet. Clearly, the size threshold for the majority of carriers serving ports like St. Paul is moving upward to the 300- to 350-ft-LOA level. Ports seeking to be involved in trade in a cost-effective manner must be able to deliver goods to this emerging class of vessels. Without harbor improvements, the Port of St. Paul will find itself precluded from servicing this emerging class of +300-ft-LOA cargo vessels.

Economic efficiencies would be realized also through reductions in vessels' movements and the reduced risk of grounding due to the larger maneuvering basin. Vessels would no longer have to exit the harbor to allow entrance of cargo vessels and barges. Deadloss to the crab harvest would be expected to be reduced because fishing vessels would not be delayed in entering the harbor or have to interrupt offloading to allow larger vessels and barges to maneuver in the harbor.

5.6.2 Reduced Wave Overtopping.

Construction of the three offshore reefs would improve harbor conditions through reductions in wave overtopping and wave energy transmitting through the breakwater. Reductions in these would improve worker safety and reduce the amount of time that harbor activities must be stopped. Damage to public and private facilities, such as buildings, equipment, the access road on the lee side of the breakwater, docking facilities, and vessels, would be reduced. Construction of permanent structures to replace temporary facilities and efficient use of the limited area in the harbor would be possible with the reductions in wave overtopping and wave energy transmitting through the breakwater.

5.6.3 Environmental.

General. Construction of the St. Paul Harbor modifications would not impact the relatively quiescent waters within Village Cove, nor would it affect the wave climate or sediment supply of adjacent shorelines to the south and west of Village Cove. Onshore-offshore sediment transport is difficult to assess; the effect of the harbor modifications on these processes cannot be predicted accurately.

Water circulation within Village Cove is driven predominantly by waves during storm conditions and by tides during relatively calm seas. The offshore reefs would not affect the circulation patterns in Village Cove and are not expected to significantly impact the overall tidal exchange or water quality.

The spending beach is proposed in an area inside the harbor which shows poor circulation under present conditions. Relatively "dead" water in this location would be displaced by fill for the spending beach. This could result in improved flushing and circulation in the harbor due to a more focused circulation pattern for the incoming wave energy between the eastern edge of the spending beach and the Boulder Spit shoreline adjacent to Salt Lagoon.

Salt Lagoon. The expected results from the wave energy channel are the return of the historic storm-induced water exchange into Salt Lagoon, which would restore biological productivity to ensure healthy bird, fish, and shellfish populations. The Salt Lagoon mitigation is discussed in detail in section 6.

5.7 Plan Implementation

5.7.1 Construction.

Federal. The Corps of Engineers would be responsible for construction of the offshore reefs and the spending beach, and for dredging the maneuvering basin and entrance channel.

Local. The local sponsor would be responsible for providing all lands, easements, and rights-of-way (including suitable dredged material disposal sites) necessary for the project; for dredging the mooring area adjacent to its dock; for construction of the sheet pile protection adjacent to the dock; and for funding its share of the Federal major navigational items. Land interests necessary for the project are discussed in subsection 5.7.3. Cost sharing of the General Navigation Features is further explained in subsection 5.7.4.

The Local Cooperation Agreement (LCA) for the original St. Paul Harbor project would be modified. Two requirements of the non-federal sponsor in the existing LCA have not been constructed as yet because the current harbor use and harbor facilities are vastly different from those anticipated when the harbor was completed in 1990. The requirement for the sponsor to construct mooring dolphins in the harbor would be deleted, since the need for them has not materialized. The requirement for the sponsor to construct additional dock space would be deleted because with the addition of the TDX dock and the *Unisea* processor (which is used as dock space), 1,000 feet of dock space exists, which is 100 feet more than the 900 feet required in the original LCA.

5.7.2 Operation, Maintenance, and Replacement (OM&R).

An analysis of sediment deposition and scour was performed using data from hydrographic surveys taken in 1992 and 1995. Visual observations of the 3-D model indicate that sedimentation problems with the proposed project would be very minor. Coal tracer tests from all wave heights and periods indicated that no sediment would enter through the harbor entrance. Sediment would enter through the shore opening between the detached breakwater and shore, and deposit between the spending beach and the boulder spit. A gyre was formed in the crescent-shaped arc on the east side of the spending beach in which the majority of incoming sediments were deposited. The small remaining quantities moved farther into the harbor.

In the 5 years since the project was constructed, the only shoaling that has appeared is a tongue off the head of the detached breakwater. However, deepening the entrance channel and maneuvering channel would provide a larger area in which sediment could be deposited. This action would also create new side slopes that might readjust. Based on experience to date, maintenance dredging is expected to be minimal.

The 2-D model studies indicated that the design for the offshore reefs would result in a stable structure. However, if future repairs were needed, they could be performed by barge in a manner similar to the initial construction.

5.7.3 Real Property Interests.

Land Ownership. Most lands in the immediate vicinity of the project are owned by the city of St. Paul. The only other major landholder on St. Paul Island is Tanadgusix, Inc. (TDX), a village corporation designated by the Alaska Native Claims Settlement Act (ANCSA). The Aleut Corporation, the regional corporation created by ANCSA, holds the subsurface estate in the entire island of St. Paul. The State of Alaska owns all tidelands in the area of the project.

Lands, Easements and Rights-of-Way. The local sponsor would be responsible for providing all the lands, easements, and rights-of-way (LERRD) necessary for project construction, as shown in table 9. The land acquisition requirement is estimated to total 7 acres. The General Navigation Features not identified in the table are below mean high water and subject to navigational servitude.

TABLE 9.--*Land interests required for harbor improvements*

Feature/portion	Acres	Current owner	Interest	Cost estimate
Dredged material disposal site	5.0	City of St. Paul	Temporary easement	$10,000
Construction staging	2.0	City of St. Paul	Temporary easement	5,000
Administrative costs:				8,000
Contingency				2,000

5.7.4 Cost Apportionment.

Construction costs for the project would be apportioned in accordance with the Water Resources Development Act of 1986. The fully funded cost apportionment for project features is summarized in table 10.

TABLE 10.--*Apportionment of construction costs ($000)*

	Fully funded expenditures	
Item	**Federal**	**Non-Federal**
General Navigation Features		
Initial cost	13,377	4,460[a]
Final 10% payment	(1,783)	1,783[b]
TOTAL	11,594	6,243
Inner harbor facilities		1,716
LERRD[c]		27[b]

[a] Initial local share of 25% cash payment of cost of general navigation features. Assumes July 1998 as midpoint construction date.
[b] Final 10% may be repaid to the Federal Government during a period not to exceed 30 years after completion of the project. LERRD is credited to final 10% payments.
[c] Lands, easements, rights-of-way, utility relocations, and dredge spoil disposal areas.

The initial construction cost of the General Navigation Features is 75 percent for the initial Federal investment and 25 percent for the initial local share. (These percentages apply to all aspects of the project except dredging that portion of the maneuvering basin which is less than 20 ft deep; the initial Federal share is 90 percent of the cost of this portion.) See table 6. The non-federal sponsor (city of St. Paul) must also contribute an additional 10 percent, plus interest, during a period not to exceed 30 years after completion of the General Navigation Features. The sponsor would be credited toward this 10-percent cost with the value of lands, easements, rights-of-way, utility relocations, and dredge spoil disposal areas (LERRD) necessary for construction, operation, and maintenance of the general navigation features. The sponsor is also responsible for 100 percent of the construction cost of the inner harbor facilities, which includes dredging the mooring area.

The Federal Government would assume 100 percent of the operation and maintenance costs for the Federal portions of the project. The non-federal sponsor would assume all other operation and maintenance costs. The sponsor would be responsible for providing LERRD for construction and future maintenance of the project.

In addition to the sponsor's share of costs for General Navigation Features, the sponsor is responsible for costs associated with other NED and non-NED features. The Pertinent Data table in the front of this report provides a summary of all shared costs.

5.7.5 Financial Analysis.

The city of St. Paul has demonstrated capability to finance its share of the project. Funds appear to be available from a variety of sources. The State of Alaska has given this project a high priority on its list of Corps harbor projects needing matching funds, and has estimated $4.7 million would be needed. The State strongly supports the expansion. The city would also receive LERRD credits for easements and dredge disposal sites.

Two funding sources are tied to the fisheries resource. The city of St. Paul is the second largest recipient of fisheries revenue from the State of Alaska under the Alaska statutes that provide for revenue sharing of State fisheries taxes with local communities. The city receives these revenues each year, depending on the health of the industry and the market price, calculated on the amount of seafood delivered within the 3-mile limit to St. Paul Island. These funds have risen significantly for St. Paul over the last 5 years as a result of St. Paul's harbor development, which has led to three processors locating facilities there. Revenues for 1995 exceeded $2.5 million. These sums are unencumbered revenues of the city of St. Paul, which can be appropriated by the city council by ordinance as necessary to meet local share requirements.

The second funding source tied to fisheries is the Community Development Quota Program (CDQ), which has been reauthorized by the U.S. House of Representatives in the Magnuson Reauthorization and by the Senate Commerce Committee. Under the CDQ program, infrastructure development is a legitimate use of the resources allocated to qualifying local communities (which include St. Paul). The program allocates 7.5 percent of the groundfish, halibut, sablefish, and crab resource in the

Bering Sea to qualifying coastal communities in Alaska. The State of Alaska, which determines how the money can be spent and by which communities, has approved the use of CDQ money by the CDQ group on St. Paul Island (the Central Bering Sea Fisherman's Association [CBSFA]) as part of the local match for the feasibility study and the planning, engineering, and design phases. In approving the CDQ budget for the CBSFA, the State CDQ working group and the governor have indicated that the resources would be available for local match on the harbor improvements, as the improvements benefit the local, State, regional and national fisheries.

Section 3 of Public Law 104-91 requires the Secretary of Commerce to report to Congress on October 1, 1996, those steps that are needed to complete the phaseout of the fur seal harvest and the transition of the Pribilof Islands' economy to fishing. Thirty million dollars have been authorized to implement this provision. The improvements to St. Paul Harbor are definitely one of the items that need to be completed.

The city of St. Paul and the State of Alaska are in an excellent position to finance the local share of this project. The city of St. Paul has been willing and able to provide local match funds for the reconnaissance and feasibility phases in a timely and expedited manner, and has a very high commitment to complete the project.

6. SALT LAGOON MITIGATION

6.1 Plan Description

6.1.1 Proposal.

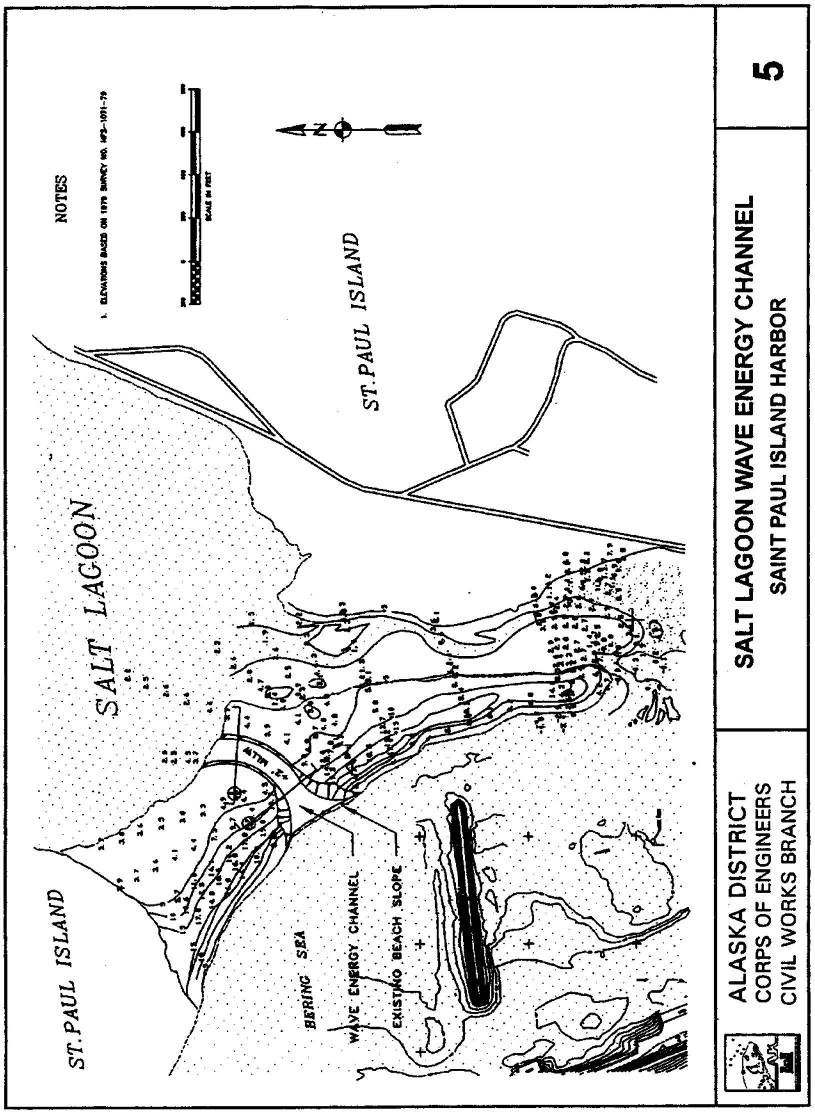
To restore the Salt Lagoon, adjacent to the St. Paul Harbor, to its historic levels of biological productivity, two modifications to the existing harbor project are proposed. The major modification would be a wave energy channel that would allow storm waves to propagate a large influx of ocean water into the lagoon. Also, the natural entrance channel to the lagoon would be realigned to its pre-project location and configuration.

The wave energy channel is shown in figure 5. It would be constructed outside the harbor north of the detached breakwater, crossing Boulder Spit. The bottom would be 100 ft wide at +2 ft MLLW. The seaward end of the channel would be wider than 100 ft to funnel waves through Boulder Spit; the center line would curve to the north. Side slopes would be 1V:5H. A jetty to guide water flow would be built in Salt Lagoon using excavated material. The seaward half of the channel sides and bottom would be armored with two layers of boulders salvaged from the channel excavation and adjacent area on Boulder Spit. The Salt Lagoon end of the channel would be armored on the bottom with one layer of salvaged boulders, and one side would be armored with two layers. The other side would have no boulders but would be left with *in situ* materials.

6.1.2 Feature Being Modified.

Boulder Spit is the natural west boundary of the St. Paul Harbor. The spit would be modified just outside the detached breakwater. A notch would be excavated in the spit and a wave energy channel dredged to Salt Lagoon. Approximately 30,000 cubic yards of material would be excavated and the channel fortified with rock salvaged from Boulder Spit and adjacent areas.

The natural entrance channel to Salt Lagoon, located within the harbor, received storm damage during construction that left a smaller channel with less tidal exchange. This natural channel would be reestablished at its pre-project location and configuration.


ST. PAUL ISLAND
SALT LAGOON
BERING SEA
WAVE ENERGY CHANNEL
EXISTING BEACH SLOPE
ST. PAUL ISLAND
NOTES
ALASKA DISTRICT
CORPS OF ENGINEERS
CIVIL WORKS BRANCH
SALT LAGOON WAVE ENERGY CHANNEL
SAINT PAUL ISLAND HARBOR
5

6.1.3 Rationale for Modification.

Prior to the construction of the harbor breakwaters, approximately 20 percent of the water volume in Salt Lagoon was tidal exchange. Numerical models concluded that the presence of the breakwaters would decrease the tidal exchange by 4 percent. The remnant of a failed breakwater (at the present breakwater alignment), constructed in the mid-1980's by local interests, focused the wave energy of a large storm to the Salt Lagoon entrance channel. The storm occurred in the winter of 1988-89, after the completion of the harbor design but prior to the start of construction in May 1989. The results of the storm altered the configuration and location of the mouth of the entrance channel to Salt Lagoon. The entrance channel was shortened and constricted, with less water exchange with Village Cove than historically.

In the past, Salt Lagoon also received substantial water during certain storm events. Storm-generated water entered through the natural entrance channel and was held in Salt Lagoon. The construction of the breakwaters has eliminated the storm-generated water exchange.

Salt Lagoon has experienced a loss in production of marine invertebrates from historical levels. These marine organisms are vital in the food web of many of the 200 species of birds that nest, stage, or rest on the Pribilof Islands. Marine vertebrates (fishes) and invertebrates (decapods, *e.g.*, crabs and shrimp) forage on organisms from Salt Lagoon. The lagoon's loss of productivity appears to be a combination of eutrophication, pollution, oxygen depletion, and changes in salinity. All of these factors are related to the decrease of water exchange. A study conducted by the Academy of Sciences of Russia (Flint and Rybnikov 1994) concluded that the productivity of Salt Lagoon is declining rapidly because of eutrophication caused by a reduction in water exchange.

The purpose of the entrance channel realignment modification is to increase the tidal water exchange to Salt Lagoon. The wave energy entrance modification would allow "flushing flows" into Salt Lagoon from storm waters. These two modifications would return Salt Lagoon to its historic biological productivity.

6.1.4 Expected Results from Modification.

Two hundred twenty-seven acres of historically extremely high biological productivity would be affected by the proposed modification. Salt Lagoon is undergoing measurable degradation from lack of water exchange with Village Cove. The proposed modifications would renew the tidal exchange and would restore storm water flooding, which appears to be an important natural process in flushing Salt Lagoon and the entrance channel.

Salt Lagoon would be restored to conditions supporting large numbers of both shore birds and sea birds. Thousands of rock sandpipers (the most abundant bird in Salt Lagoon), as well as hundreds of both black and red-legged kittiwakes, can be seen at the lagoon at any given time in summer. Salt Lagoon is an important stopover for migratory birds, as it is the only land mass for 200 miles. Non-marine water-related birds, such as shore birds, use Salt Lagoon as a resting area during their northern or southern migrations. The expected results from the modifications are the return of the historic water exchange, both tidal and storm-induced, to Salt Lagoon.

6.1.5 Importance of Output from Modification.

Salt Lagoon is an important habitat for many birds, fishes, and marine invertebrates. Salt Lagoon produces a large amount of biomass, more than 400 pounds per acre of polychaetes alone. These organisms provide food for numerous large invertebrates (including Korean horsehair crab), fishes (cod, sandfish, and juveniles of several species of commercially caught sole, Atka mackerel, and sockeye salmon) and birds (kittiwakes, rock sandpipers, turnstones, and gulls). The planktonic and water-column organisms are being flushed out of the lagoon into Village Cove and the Bering Sea twice a day. The contribution of Salt Lagoon to the immediate area of Village Cove is significant. Juvenile pollock and other codid fishes are abundant in Village Cove; biological output from Salt Lagoon is one of the major factors.

The Russian institute's study concluded with great concern about the ecological health of Salt Lagoon. The study concluded that a daily 20-percent water exchange rate in Salt Lagoon is necessary to prevent its eutrophication. It further stated that this ratio cannot be achieved under present conditions. The output of the proposed modification would stabilize (and increase to pre-project levels) the quickly eroding biological productivity of Salt Lagoon.

6.1.6 Land Use and Acquisition.

The Tanadgusix Corporation (TDX, the local Native corporation) owns the Boulder Spit, and the city of St. Paul owns the land at the mouth of the existing lagoon entrance channel. TDX has indicated it would assist in the project. No additional lands appear to be needed.

6.1.7 Engineering Techniques.

Although the construction of a wave energy entrance channel is innovative, the construction of a rock-lined channel is a common engineering practice.

6.2 Consistency With Project Purpose

The St. Paul Harbor was constructed to assist the fishing fleet in the Bering Sea fishery. The proposed modification would not change the purpose of the original project. The proposed modification would not have an impact on the harbor, either adverse or beneficial.

6.3 Views of Sponsor

The non-federal sponsor, the city of St. Paul, supports the modification. The Salt Lagoon is an important resource to the people of St. Paul and has been protected from future development through the land use management plans of the community. The Central Bering Sea Fisheries Association and the TDX Corporation are interested parties which may contribute assets to the proposed modification. The city of St. Paul has reviewed the preliminary design and is in complete concurrence. The city expressed a desire to improve Salt Lagoon water quality and circulation in a letter dated December 28, 1994, included in appendix D.

6.4 Views of Federal, State and Regional Agencies

The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) support the concept of improving water exchange into Salt Lagoon. St. Paul Island is in the Alaska Maritime National Wildlife Refuge, administered by USFWS. NMFS has been associated with the Pribilof Islands for many years. These two agencies have taken the lead in projects associated with the Pribilofs. Although they concur with the concept of the wave energy entrance channel, they are suspending final judgment until the project has progressed.

All other agencies, Federal, State and local, support the proposed modification. The Pribilof Islands are a unique biological habitat in the region of North America, in the same class as the Galapagos Islands near South America. The interest of the entire environmental community is focused on projects associated with the Pribilof Islands. The community of St. Paul, USFWS, NMFS, and to a lesser extent, agencies of the State of Alaska are part of the planning process for this modification. Because these agencies are part of the planning team, the final product will be endorsed by all parties.

6.5 Benefits

Reestablishing the Salt Lagoon entrance channel in its historic location and configuration should return the tidal exchange with Village Cove to near 20 percent by volume. The wave energy entrance would allow large amounts of water to enter the Salt Lagoon during storm conditions. The water would exit Salt Lagoon through the entrance channel (not the wave energy channel), which would move accumulated material at the entrance channel mouth and maintain channel capacity. The storm flooding would also assist in the overall exchange of water in Salt Lagoon. These storms occur an average of 10 to 15 times per year.

To justify the proposed work, the past, present, and future productivity of the Salt Lagoon without the modifications was compared to that expected after the modifications. Two groups of organisms, burrowing polychaetes and gammarid amphipods (suborder), were selected as indicator species. Both groups of organisms are important in processing detritus, as well as being the primary prey species for fishes and birds that use Salt Lagoon and the surrounding marine environment. The thousands of shore birds that feed at Salt Lagoon primarily feed on the gammarid amphipods.

No existing habitat suitability index (HSI) is established for these organisms. Experts from NMFS who have studied benthic organisms in Salt Lagoon and the Pribilof Islands were consulted. They indicate that Salt Lagoon is extremely productive, especially when compared to other near-shore waters and lakes at St. Paul. The Academy of Sciences of Russia's report (Flint and Rybnikov 1994) calculated biomass of species in grams per square meter at 15 stations throughout Salt Lagoon and the entrance channel. Using the biomass estimates and expert opinion on near-shore macroinvertebrates, HSI's were established for three scenarios: present value, future value without modifications, and historic value/future value with modifications. These values are tabulated below. The HSI for the future without modifications follows the existing trend in eutrophication to a point where tidal exchange is minimal and no water is exchanged during storms.

Taxa group	Present condition	Future without modifications	Future with modifications
Polychaetes	0.5	0.3	0.6
Gammarids	0.7	0.3	0.8

The gain in habitat units (HU) for polychaetes between the no-action alternative and the proposed modifications is 68. The increase for gammarids is 114 HU. The average annual cost of the proposed modifications is $73,000. The combined average annual cost per cumulative HU (182) is $385.

Other benefits that would be derived from the proposed modifications include tourism. St. Paul Island is known throughout the world for its bird populations. Apart from the sea bird colonies, St. Paul is also visited by numerous exotic (non-native to the United States) bird species. Salt Lagoon is a haven for visiting shore birds. Bird watchers from all over the United States and many foreign countries visit St. Paul Island, and Salt Lagoon is one of the major attractions.

The proposed modifications are being coordinated with the National Marine Fisheries Service and meet the requirements of the Cooperative Agreement to Restore and Create Fish Habitat, a national agreement between the NMFS and the Corps of Engineers. The proposed action also fulfills the criteria of Coastal America, a national program for the restoration of America's coastline environs.

6.6 Implementation

The design and construction of the wave energy channel would be conducted in several steps. Model studies would be conducted during Preconstruction Engineering and Design (PED) to evaluate the wave energy channel. Wave heights, circulation patterns, and shoaling in the harbor would be evalulated during the PED model studies to assess any impacts the energy channel may have on these parameters. Resource agencies would be invited to the Waterways Experiment Station in Vicksburg to assist in interpreting model results. The wave energy channel would be specified to be constructed first during the harbor construction contract. Monitoring would be conducted during the remainder of the construction contract to evaluate the effectiveness of the wave energy channel. Monitoring would be accomplished by the Corps of Engineers and resource agencies. The channel would be modified at the end of the construction contract period if necessary to achieve the desired ecosystem benefits.

6.6.1 Construction.

Federal. The Corps of Engineers would be responsible for construction of the Salt Lagoon wave energy channel.

Local. The local sponsor would be responsible for providing all lands, easements, and rights-of-way (including suitable material disposal sites) necessary for the project and for funding its share of the Salt Lagoon mitigation. Land interests necessary for the project are discussed in subsection 6.6.3. Cost sharing of Salt Lagoon mitigation is further explained in subsection 6.6.4.

6.6.2 Operation, Maintenance, and Replacement (OM&R).

The wave energy channel would require annual maintenance to relocate boulders displaced by storm waves. This is anticipated to be less than 2 weeks of effort for one front-end loader/backhoe, one operator, and one laborer. Due to the high cost of mobilizing and demobilizing a construction contractor for Federal construction, and since the non-federal sponsor has equipment and labor already on the island, the non-federal sponsor would assume responsibility for maintaining the wave energy entrance into Salt Lagoon in return for a one-time construction credit. Annual maintenance is estimated to be $16,900 per year. The present worth for 50 years of maintenance is estimated to be $215,000. The one-time construction credit will be the lesser of $215,000 or the sponsor's share of mitigation construction costs minus credit for LERRD.

6.6.3 Real Property Interests.

Land Ownership. See subsection 5.7.3.

Lands, Easements and Rights-of-Way. The local sponsor would be responsible for providing all lands, easements, and rights-of-way (LERRD) necessary for project construction. This is estimated to total 4 acres, as shown in table 11.

TABLE 11.--*Land interests required for Salt Lagoon mitigation*

Feature/portion	Acres	Current owner	Interest	Cost estimate
Mitigation channel	4.0	Tanadgusix, Inc.	Permanent easement	$20,000
Administrative costs				4,500
Contingency				1,500

6.6.4 Cost Apportionment.

Construction cost for the mitigation project would be apportioned in accordance with the Water Resources Development Act of 1986. The fully funded cost apportionment for mitigation features is summarized in table 12. Table 13 presents the detailed estimated costs of the recommended plan for Salt Lagoon mitigation based on October 1995 price levels.

The initial construction cost allocation for mitigation is 90 percent for initial Federal investment and 10 percent for initial local share. The non-federal sponsor (city of St. Paul) must also contribute an additional 10 percent, plus interest, during a period not to exceed 30 years after completion of the Salt Lagoon mitigation. The sponsor would be credited toward this 10-percent cost with the value of LERRD necessary for construction, operation, and maintenance of the mitigation features.

TABLE 12.--*Apportionment of construction costs ($000) for Salt Lagoon mitigation*

	Fully funded expenditures	
Item	**Federal**	**Non-Federal**
Construction		
Initial cost	887	98[a]
Final 10% payment	(98)	98[b]
TOTAL	789	196
LERRD[c]		28[b]

[a] Initial local share of 10% cash payment of cost of Salt Lagoon mitigation. Assumes July 1998 as midpoint construction date.

[b] Final 10% may be repaid to the Federal Government during a period not to exceed 30 years after completion of the project. LERRD is credited to final 10% payments.

[c] Lands, easements, rights-of-way, utility relocations, and dredge spoil disposal areas.

TABLE 13.--*Detailed cost estimate for Salt Lagoon mitigation, St. Paul, Alaska (October 1995 price level)*

Item	Qty.	Unit	Unit price ($)	Contin-gency	Shared NED costs ($000)[a] Federal	Local	TOTAL
Mitigation							
Mobilization & demob.	1	LS	27,000	20%	26	6	32
Salt Lagoon wave energy channel							
Phase I							
Excavate & place boulders	12,000	yd^3	19.69	20%	227	57	284
Excav. spoils & build jetty	17,000	yd^3	11.02	20%	180	45	225
Phase II							
Excavate & place boulders	12,000	yd^3	19.69	20%	226	57	283
SUBTOTAL					633	159	792
CONSTRUCTION CONTRACTS					659	165	824
Engineering and design	1	LS	35,000	10%	31	8	39
Construction management	1	LS	41,000	10%	36	9	45
Subtotal Mitigation					**726**	**182**	**908**
Lands and damages							
Acquisitions	4	acres	5,000	6%		21	21
Administrative cost	1	LS	8,000	6%		5	5
SUBTOTAL						26	26
TOTAL PROJECT COST					**726**	**208**	**934**

[a] Features showing Federal costs are for Salt Lagoon mitigation. These can be paid in part by the Federal Government, subject to current cost-sharing laws.

7. PUBLIC INVOLVEMENT AND AGENCY VIEWS

7.1 Public Involvement

Federal agencies, local interests, and the State have participated actively in planning this project. The State coastal engineer helped develop the project features, using the 3-D model study in Vicksburg, Mississippi, to evaluate alternatives. Many public meetings have taken place since the reconnaissance study for this project began in 1994. Table 14 lists important project meetings and other public involvement events.

TABLE 14.--*Public involvement events*

Date	Event
Feb. 14-16, 1994	Public meetings in St. Paul: local residents, Federal and State agency representatives, operators of the seafood processors, and city officials attended.
May 18, 1994	Public meeting on Salt Lagoon water quality improvements, at the time a Section 1135 project, and the harbor improvements. Attendees were the Alaska District Engineer, other District personnel, local residents, and representatives from the city, TDX Corporation, Central Bering Sea Fisherman's Association, and Tribal Government of St. Paul Island.
Sep. 27, 1995	A meeting in Seattle, WA, was attended by vessel and processor operators, St Paul city officials, and District personnel.
Oct. 5, 1995 and Jan. 24, 1996	Meeting in Anchorage with Federal and State resource agencies. District and city of St. Paul presented the project and solicited comments from the agencies.
Dec. 5, 1995	Study manager gave a project briefing to the Pribilof Islands Joint Management Board. Attendees: representatives of the city, Tribal Government of St. Paul Island, TDX Corporation, National Marine Fisheries Service, U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, and Alaska Marine Conservation Council.
Jan. 10, 1996	Meeting in St. Paul: residents, city officials, and processors' representatives attended.
Jan. 29, 1996	Notice of intent to prepare a draft supplemental environmental impact statement for harbor improvements at St. Paul, AK, published in Federal Register.
April 2, 1996	Physical models for the project were demonstrated at WES in Vicksburg, MS. Representatives of the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the city, and TDX Corporation attended.

7.2 Consultation Requirements

The USFWS, the U.S. Environmental Protection Agency, and NMFS were consulted throughout the planning process. Representatives of USFWS and NMFS reviewed the two- and three-dimensional model studies and were present at WES for model demonstrations. These agencies would be involved in design of the wave energy channel for Salt Lagoon mitigation. Endangered species consultation and consultation with the State Historic Preservation Officer were conducted and finalized with the signing of the Finding of No Significant Impact, which accompanies this report.

7.3 Alaska Coastal Management Program Consistency Determinations

The proposed improvements are consistent, to the maximum extent practicable, with the St. Paul Island Coastal Management Program and the State Coastal Management Program. The Final Consistency Finding (August 2, 1996), is in appendix D.

7.4 U.S. Fish and Wildlife Service Recommendations

The four USFWS recommendations from the draft Fish and Wildlife Conservation Act Report are reiterated here. (The complete report is in Environmental Assessment appendix 2.) Each recommendation is followed by the Corps of Engineers' response.

a. Recommendation: The community of St. Paul and the onshore processors must be fully committed to continuing a rat prevention program indefinitely. This program should include, at the minimum, a person on-site dedicated to rat prevention, equipment and personnel available to make inspection of suspect vessels and enforcement of the city's rat ordinance a reality, and training for boat operators and seafood processor personnel. If trampers begin entering the harbor, it will also be necessary to do regular ship inspections to be sure they are rat-free. The U.S. Fish and Wildlife Service has cooperated in the initiation of the program and will continue to provide support, but does not have the staff or funding to adequately manage such a program year-round. It is imperative that enforcement and inspection capabilities be adequate if the Pribilof Islands are to remain rat-free.

a. Response: The City of St. Paul has reviewed this recommendation and has agreed to establish a rat prevention program as outlined. The city and U.S. Fish and Wildlife Service will jointly establish a rat prevention plan that will be implemented by the city. This plan will be in place prior to construction of the modifications and will be part of the overall project.

b. Recommendation: A hydrology modeling study should be completed to assess impacts to Salt Lagoon from the proposed wave energy channel. The study should include an evaluation of channel locations and configuration as well as alternatives, such as culverting, to enhance tidal exchange. If a wave energy channel or other water circulation method is determined by resource agencies to be environmentally beneficial, multi-year monitoring of the least auklet colony and biological components of Salt Lagoon should be required to assess the project's success and/or need for modification.

b. Response: Concur. The proposed wave energy channel will be modeled this fall. All alternatives to increase water circulation in Salt Lagoon will be reviewed, and the best alternative for Salt Lagoon as well as the least auklet colony will be selected. The alternative will be selected jointly by the Corps and Fish and Wildlife Service. A monitoring program will be established to assess the selected alternative.

c. Recommendation: In conjunction with excavation of the wave energy channel, if built, the Corps should remove wreckage (rusty pieces of an earlier shipwreck) on Village Cove Beach, to make available additional least auklet habitat.

c. Response: The Corps will remove wreckage immediately around the wave energy channel.

d. Recommendation: Timing restrictions on excavation of Village Cove Beach and construction of the spending beach are necessary to minimize disturbance to nesting least auklets. No construction activities should take place between May 15 and June 30 for these components of the project.

d. Response: Concur. The timing restrictions will be included in the Plans and Specifications.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

The studies documented in this report indicate that Federal construction of harbor improvements and Salt Lagoon mitigation at St. Paul, Alaska, as described in the recommended plan in this report, is technically possible, economically justified, and environmentally and socially acceptable. The improvements would consist of a dredged entrance channel at -30 ft MLLW with an additional 2 ft for advance maintenance; a maneuvering basin at -29 ft MLLW; a spending beach on the lee side of the detached breakwater; and three offshore reefs parallel to the main breakwater, each 1,300 ft long, at a depth of -12 ft MLLW. The Salt Lagoon mitigation would be a wave energy channel 100 ft wide at +2 ft MLLW to increase the flow of water into Salt Lagoon, and restoration of the Salt Lagoon entrance channel to its original size and location. The city of St. Paul is willing and able to act as local sponsor for the project and fulfill all the necessary local cooperation requirements. Thus it is concluded that the recommended alternatives should be pursued by the United States in cooperation with the city of St. Paul and the State of Alaska.

8.2 Recommendations

I hereby recommend that the harbor improvements and Salt Lagoon mitigation at St. Paul, Alaska, be constructed as described in the recommended plans in this report. Specific recommendations and Federal costs are as follows:

a. Harbor Improvements. Construct and maintain the harbor improvements, consisting of an entrance channel dredged to a depth of -30 ft MLLW, with an additional 2 feet of depth for advance maintenance; a 415-by-80-ft maneuvering basin dredged to a depth of -29 ft MLLW; a spending beach on the lee side of the existing detached breakwater; and three offshore reefs parallel to the existing main breakwater, each 1,300 feet long, with a top elevation of -12 ft MLLW. The initial Federal cost of the improvements is estimated at $13,377,000, with 10 percent ($1,783,000) of this cost to be repaid to the Federal Government by the sponsor over a period not to exceed 30 years. The final Federal cost of the project would be $11,594,000. The estimated cost of Federal maintenance of the project is $100,000 per year. The plan is recommended with such modifications as in the discretion of the Commander, U.S. Army Corps of Engineers, may be advisable.

I also recommend deauthorization of the previous requirement for locally constructed mooring dolphins and docks. The docks have been furnished through private development in the harbor area. With the change in the design vessel for the harbor, the mooring dolphins are no longer needed and are incompatible with the recommended enlargement of the maneuvering basin and construction of the spending beach.

Prior to construction, the local sponsor must agree to:

(1) Provide and maintain, at its own expense, the local service facilities, consisting of the mooring basin and the mooring facilities.

(2) Provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas, and perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the construction, operation, and maintenance of the general navigation features and the local service facilities.

(3) Provide all improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the construction, operation, and maintenance of the general navigation features and the local service facilities. Such improvements may include, but are not necessarily limited to, retaining dikes, wasteweirs, bulkheads, embankments, monitoring features, stilling basins, and dewatering pumps and pipes.

(4) Provide, during the period of construction, a cash contribution equal to the following percentages of the total cost of construction of the general navigation features:

(a) 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet;

(b) 25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet;

(c) 50 percent of the costs attributable to dredging to a depth in excess of 45 feet.

(5) Repay with interest, over a period not to exceed 30 years following completion of the period of construction of the Project, an additional 0 to 10 percent of the total cost of construction of general navigation features depending upon the amount of credit given for the value of lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas provided by the Non-Federal Sponsor for the general navigation features. If the amount of credit exceeds 10% of the total cost of construction of the general navigation features, the Non-federal Sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, right-of-way, relocations, and dredged or excavated material disposal areas, in excess of 10% of the total cost of construction of the general navigation features.

(6) For so long as the Project remains authorized, operate and maintain the local service facilities and any dredged or excavated material disposal areas, in a manner compatible with the Project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government.

(7) Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsor owns or controls for access to the general navigation features for the purpose of inspection, and, if necessary, for the purpose of operating and maintaining the general navigation features.

(8) Hold and save the United States free from all damages arising from the construction, operation, and maintenance of the Project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors.

(9) Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the Project, for a minimum of three years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction of the general navigation features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 CFR Section 33.20.

(10) Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, and maintenance of the general navigation features. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigations unless the Federal Government provides the Non-Federal Sponsor with prior specific written direction, in which case the Non-Federal Sponsor shall perform such investigations in accordance with such written direction.

(11) Assume complete financial responsibility, as between the Federal Government and the Non-Federal Sponsor, for all necessary cleanup and response costs of any CERCLA-regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, or maintenance of the general navigation features.

(12) To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA.

(13) Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for construction, operation, and maintenance, of the general navigation features, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

(14) Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 USC

2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army".

(15) Provide a cash contribution equal to the following percentages of total historic preservation mitigation and data recovery costs attributable to commercial navigation that are in excess of one percent of the total amount authorized to be appropriated for commercial navigation:

(a) 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet;

(b) 25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet;

(c) 50 percent of the costs attributable to dredging to a depth in excess of 45 feet.

b. Salt Lagoon Mitigation. Prior to completion of the existing project, monitoring and analyses of impacts of the existing project on Salt Lagoon, adjacent to the harbor, determined that the main breakwaters have eliminated a significant amount of storm-generated water exchange between the lagoon and the sea. Prior to construction of the existing project, tidal exchange accounted for about 20 percent of the total water exchange between the lagoon and the sea, based on studies by others, and storms accounted for the remainder. With elimination of the storm-generated water exchange, Salt Lagoon had experienced a significant loss of marine invertebrates. These marine organisms are vital in the food web of many of the 200 species of birds that nest, stage, or rest on the Pribilof Islands. In addition, marine vertebrates (fishes) and invertebrates (decapods, *e.g.*, crabs and shrimp) forage on organisms from Salt Lagoon. To restore the biological productivity of Salt Lagoon, I recommend that the existing project, authorized by Public Law 99-662, be modified to include construction and maintenance of a wave energy channel through Boulder Spit outside the harbor north of the existing detached breakwater, and realignment of the natural entrance to the lagoon to its pre-project location and configuration. The proposed dimensions of the wave energy channel are a bottom width of 100 feet at +2 ft MLLW. Actual dimensions and location of the channel will be determined through model studies prior to construction.

Total construction costs are estimated to be $985,000, with an initial Federal cost of $887,000 and a final cost of $789,000, following payment of 10 percent of the total cost by the sponsor over a period not to exceed 30 years. The Federal cost of annual maintenance of the channel is estimated to be $16,900 per year. Due to high mobilization costs and the fact that maintenance is expected to be required every year, for the convenience of the Government, I recommend that annual maintenance of the channel be assumed by the sponsor in exchange for a one-time construction credit. The credit would be based on the estimated present value of the annual maintenance cost over the 50-year project life, which amounts to $215,000. The construction credit will be the lesser of $215,000 or the sponsor's share of mitigation construction costs minus credit for LERRD.

To implement the recommended mitigation measures, I further recommend that the document, "Agreement Under Section 204(e) of Public Law 99-662 between the Department of the Army and the City of St. Paul, St. Paul Island, Alaska for Construction of the St. Paul Island Harbor Project," signed by the Department of the Army on March 31, 1989, and by the City of St. Paul, Alaska, on March 30, 1989, be amended to include the recommended modifications to the existing project, or alternatively a new agreement covering the mitigation may be executed if appropriate.

The recommendations for implementation of harbor improvements and measures to mitigate impacts of the existing uncompleted project on Salt Lagoon at St. Paul, Alaska, reflect the policies governing formulation of individual projects and the information available at this time. They do not necessarily reflect the program and budgeting priorities inherent in the local and State programs or the formulation of a national civil works water resources program. Consequently, the recommendations may be changed at higher review levels of the executive branch outside Alaska before they are used to support congressional authorization and funding.

Peter A. Topp

Date: 12 Aug 96

PETER A. TOPP
Colonel, Corps of Engineers
District Engineer

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[First Endorsement]

CENPD-ET-P (CENPA-EN-CW-PF/12 Aug 96)
Mr. Wagner/kb/503-326-3830
SUBJECT: Harbor Improvements Interim Feasibility Report and Environmental Assessment, St. Paul, Alaska

CDR, North Pacific Division, Corps of Engineers, PO Box 2870, Portland, OR 97208-2870

16 August 1996

FOR CDR, USACE (CECW-ZA), 20 MASS AVE NW, WASH, DC 20314-1000

I concur in the conclusions and recommendations of the District Commander.

Bartholomew B. Bohn

BARTHOLOMEW B. BOHN II
Colonel, EN
Acting Commander

FINDING OF NO SIGNIFICANT IMPACT
AND
ENVIRONMENTAL ASSESSMENT

ST. PAUL HARBOR IMPROVEMENTS
ST. PAUL ISLAND, ALASKA

In accordance with the National Environmental Policy Act of 1969, as amended, the U.S. Army Engineer District, Alaska, has assessed the environmental effects of the following action:

St. Paul Harbor Improvements
St. Paul Island
St. Paul, Alaska

The harbor improvements project will consist of four actions:

1. Construction of three parallel offshore reefs in front of the main breakwater. The reefs will require approximately 117,000 cubic yards (yd^3) of rock (75,000 yd^3 of armor stone and 42,000 yd^3 of bedding stone) to cover about 9 acres of subtidal substrate.

2. Dredging approximately 130,000 yd^3 of material to reach -32 feet MLLW for the 14- acre entrance channel. The maneuvering basin will be at -29 feet MLLW and will require the dredging of 220,000 yd^3 of material from an area of about 10 acres.

3. Construction of a spending beach behind the detached breakwater to reduce wave heights within the harbor. The spending beach will require 60,000 yd^3 of dredged material and 18,000 yd^3 of rock to bring the fill to +4 feet MLLW around the perimeter and 0 feet MLLW in the middle. The intertidal fill will be about 3 acres.

4. Construction of a wave energy channel into Salt Lagoon. The preliminary dimensions are for a 100-foot-wide channel with a channel invert at +2 feet MLLW. However, the interagency team will modify the project as necessary to avoid environmental impacts.

Public and agency review comments addressed the potential for accidental rat introduction from cargo vessels and their effects on the bird colonies. A rat protection program will be implemented by the city of St. Paul.

Based on the analysis presented in the environmental assessment, the Section 404(b)(1) evaluation under the Clean Water Act, State and Federal agency reviews, and public review, no significant environmental impacts will occur from the project. The action does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, an environmental impact statement is not necessary for the St. Paul Harbor improvements project.

Peter A. Topp
Colonel, Corps of Engineers
District Engineer

31 JUL 96
Date

ST. PAUL HARBOR IMPROVEMENTS
ENVIRONMENTAL ASSESSMENT

ST. PAUL ISLAND, ALASKA

Contents

CONTENTS --(continued)

Figures

Tables

Appendixes

St. Paul Harbor Improvements
St. Paul Island, Alaska
Environmental Assessment

1. INTRODUCTION

1.1 Need for the Proposed Action

The St. Paul Harbor was designed for a fleet of 65 vessels with an average length of 110 feet, a 35-foot beam, and an unloaded draft of 12 feet. The entrance channel and maneuvering basin were designed to accommodate only unladen fishing vessels going into the harbor to refuel and stock provisions. Large loaded vessels were not expected to use the harbor because it was believed that all transfers of fish product would occur at the fishing grounds.

St. Paul Harbor currently serves a fleet of 230 vessels during crabbing season. Twenty-seven floating processors were within the 3-mile limit around St. Paul Island in 1994. Unisea Seafoods moved a floating crab processing plant from Dutch Harbor to the city dock, and Icicle Seafoods has moored a processor at the local Native corporation dock. The Trident shore processor is upland, adjacent to the harbor. Natural Resources Consultants, Inc.(NRC) evaluated the harbor and identified three major problems: (1) the navigational channel and turning basin is not wide, long, or deep enough for adequate vessel navigation; (2) overtopping of the breakwater during storms creates unsafe conditions in the harbor and damages equipment and vessels; and (3) surge from wind-generated swells and overtopping damages docks and vessels at moorage (NRC 1996).

Construction of the main and detached breakwaters in 1989 decreased the amount of water entering Salt Lagoon during severe storms. This has caused a major shift in the ecological function and biodiversity in the lagoon and is adversely affecting shorebirds and other important biota.

1.2 Authority

This study is authorized by a resolution adopted on December 2, 1970, by the Committee on Public Works of the U.S. House of Representatives, Document Number 414, 83rd Congress, 22nd Session.

The harbor improvements phase of the St. Paul Harbor project was requested by the city of St. Paul in late winter 1993. The city's request cited navigation problems with the existing harbor. A reconnaissance report was completed in July 1995, recommending a feasibility study for navigation improvements at St. Paul Harbor.

1.3 Scope of the Environmental Assessment

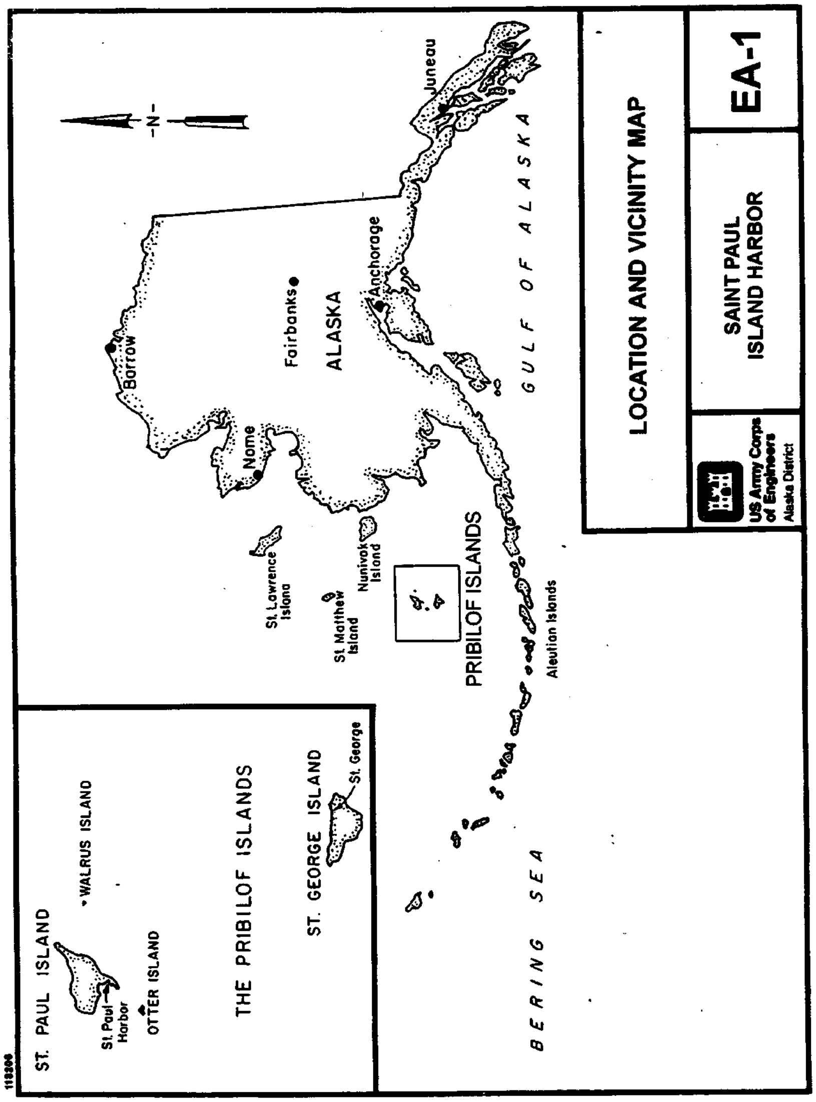
This document addresses the environmental effects from dredging the harbor entrance channel and maneuvering basin, the disposal of the dredged material, and the construction of the offshore reefs. The analysis includes direct, cumulative, and secondary impacts associated with the proposed action. An environmental impact statement (EIS) for the boat harbor was prepared and distributed for public review in 1982. With the signing of the Record of Decision (ROD) in December 1986, the requirements of the National Environmental Policy Act (NEPA) were completed. In 1984 and 1985, the city of St. Paul constructed a 750-foot-long breakwater. The breakwater was damaged by a storm during construction in December 1984, and the breakwater was rebuilt in 1985. The city asked for Federal assistance to extend the breakwater, and an environmental assessment (EA) and a Finding of No Significant Impact (FONSI) were completed in February 1987 to evaluate the use of Federal funds for the project. The Federal Government adopted the project in 1987. The new design added several features that required new public input, and an environmental assessment was prepared and distributed for public review in February 1988. The comments from the Federal and State agencies, the city of St. Paul, and the general public were incorporated into the design, and the FONSI was signed in April 1988. The Federal project, which was completed in 1990, extended the breakwater to 1,800 feet and added a 970-foot-long detached breakwater. The major change in the EA from the project described in the EIS was the construction of the detached breakwater and the associated impacts.

All environmental stipulations and requirements included in the 1982 EIS and in the 1987 and 1988 EA's would be followed for the proposed action. Consequently, this assessment does not address broader issues of project effects that were considered in the previous documents. This EA does address, however, adverse effects of the previous construction that have been identified since the last NEPA document was prepared in 1988. The 1982 feasibility report and EIS, the 1987 EA, and the 1988 General Design Memorandum and EA are incorporated by reference into this environmental assessment.

2. PROJECT DESCRIPTION

2.1 Project Location

St. Paul Island is in the Pribilof Island group in the eastern Bering Sea, approximately 775 air miles west of Anchorage, Alaska (figure EA-1). The island is of volcanic origin, and topography includes volcanic hills, basalt ridges, and sand dunes. The city of St. Paul is on a narrow, sandy peninsula on the extreme south end of the island. The harbor is in Village Cove, adjacent to the city of St. Paul.


ST. PAUL ISLAND
WALRUS ISLAND
St. Paul Harbor
OTTER ISLAND
THE PRIBILOF ISLANDS
ST. GEORGE ISLAND
St. George
BERING SEA
Aleutian Islands
PRIBILOF ISLANDS
St. Matthew Island
St. Lawrence Island
Nunivak Island
Nome
Barrow
Fairbanks
ALASKA
Anchorage
GULF OF ALASKA
Juneau
N
LOCATION AND VICINITY MAP
SAINT PAUL ISLAND HARBOR
EA-1
US Army Corps of Engineers
Alaska District

2.2 Design Criteria

The project's purpose is to design and construct harbor improvements to provide a safe and efficient harbor in an environmentally and economically sound manner. Project safety criteria depend on the size and maneuverability of the vessels using the waterway, the size and type of channel and navigational aids provided, the effects of currents and wind, and the experience and judgment of pilots. All these factors must be considered to design a safe and usable harbor. The size of the wave in the mooring basin and at the dock is a major factor affecting safety and usability. Design manuals recommending wave-height criteria have been established by the Corps of Engineers and the U.S. Navy. Corps guidance recommends limiting the maximum allowable wave height for vessels less than 100 feet in length to 1 foot in berthing areas and 2.5 feet in anchorage areas. The Navy manual, which was designed for larger vessels, states that wave height in the berthing basin should not exceed 2.5 feet for comfortable berthing, but in no case should the wave exceed 4 feet. Although the proposed harbor improvements are to allow larger vessels to enter and use the harbor, the wave climate in the basin must also allow safe moorage for the smaller vessels.

2.3 Selected Plan

The selected plan consists of the following actions:

1. Deepen and widen the existing harbor entrance channel and maneuvering basin.

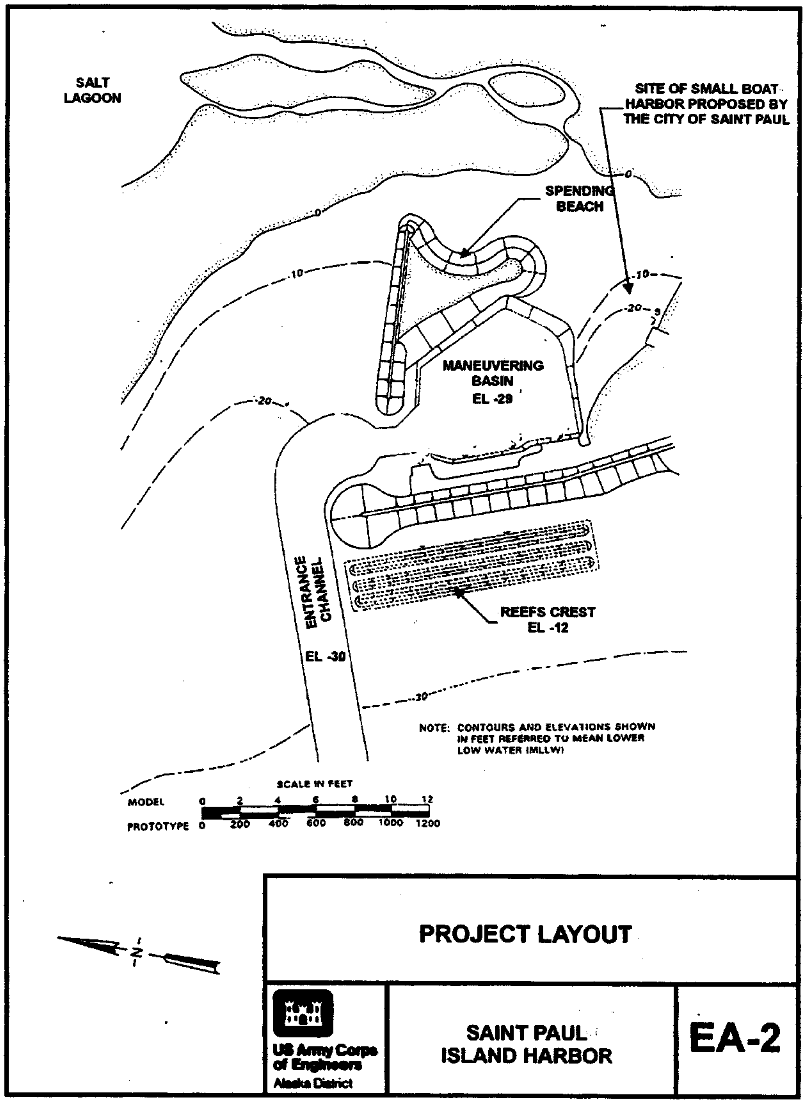
2. Reduce waves overtopping and wave energy transmitted through the breakwater due to storm waves.

3. Increase water circulation in Salt Lagoon from storm events.

2.3.1. Deepen and Widen the Entrance Channel and Maneuvering Basin. The selected plan would extend the entrance channel to about 900 feet from the main breakwater (figure EA-2). The entrance channel width would vary: the bottom width would be 150 feet between the breakwaters, increase to about 300 feet at the turn, and would be 250 feet wide for the remaining length. Approximately 130,000 cubic yards (yd^3) of material classified as sand would be dredged to reach the proposed channel width and project depth of -30 feet MLLW.

The proposed maneuvering basin would be 415 feet by 830 feet inside the harbor for vessel turnaround and docking at a depth of -29 feet MLLW.

NRC determined the size of the design vessel (the optimal vessel in determining harbor design improvements) by interviewing processors, catcher boat operators, and other operators of marine vessels and facilities. The design vessel for St. Paul Harbor


SALT LAGOON
SITE OF SMALL BOAT HARBOR PROPOSED BY THE CITY OF SAINT PAUL
SPENDING BEACH
MANEUVERING BASIN EL -29
ENTRANCE CHANNEL
EL -30
REEFS CREST EL -12
NOTE: CONTOURS AND ELEVATIONS SHOWN IN FEET REFERRED TO MEAN LOWER LOW WATER (MLLW)
SCALE IN FEET
MODEL 0 2 4 6 8 10 12
PROTOTYPE 0 200 400 600 800 1000 1200
N
PROJECT LAYOUT
US Army Corps of Engineers
Alaska District
SAINT PAUL ISLAND HARBOR
EA-2

is 325 feet long, has a 50-foot beam, and a loaded draft of 23 feet. This vessel represents typical freighters currently operating in the area.

The 1989 harbor was designed to accommodate unladen fishing vessels going into the harbor to refuel and stock provisions. All the processors at that time were outside the harbor. Several processors have since moved inside the harbor: Unisea moved a floating crab processing ship to the city dock, one processor moved to the Native corporation dock and one processor is located on land within the harbor area. These additions mandate that cargo vessels enter the harbor to directly load large amounts of processed product, a condition that escalates congestion in a harbor already overtaxed by the refueling and stocking requirements of a fishing fleet three times larger than the harbor was designed to handle.

Currently, seafood products processed in the harbor are carried out of the harbor by barges, small domestic break-bulk carriers, and one small container vessel. Foreign freighters are the least expensive means of moving cargo to Japan or other foreign ports, which receive the majority of seafood products shipped from St. Paul. These vessels are excluded entirely from dockside cargo transfers in St. Paul because of their size and physical characteristics.

The proposed dimensions of the maneuvering basin are related to the length of vessel using the facility. Maneuvering basin width was determined by the design vessel length times 1.5 for turning. The basin design is elongated to allow for drift, which could occur from currents or wind in the harbor, and for stopping a vessel this size. The added length would provide a sufficient safety factor to allow multiple uses in the harbor. Approximately 220,000 yd^3 would be dredged to meet the basin size at a depth of -29 feet MLLW. This depth was established using the design vessel with a draft of 23 feet.

The effects of widening and deepening the entrance channel and maneuvering basin on wave heights in the harbor were assessed using a three-dimensional model constructed at WES. As stated in Section 2.2, wave heights over 2.5 feet are unacceptable.

The three-dimensional model was also used to assess the effects of the proposed fill behind the detached breakwater on wave heights in the harbor. Different wave heights and wave periods were used with the overtopping alternatives array, with and without a fill behind the detached breakwater, and with fills of different configurations. The model study indicated that dredging the entrance channel and maneuvering basin increased wave heights in the harbor. The offshore reefs helped decrease wave heights, but a spending beach (a type of fill behind the detached breakwater) with 1:5 slopes subtidally and 1:10 slopes intertidally was the only configuration that reduced the wave height climate to acceptable limits in the harbor. The shape of the spending beach proved to be critical. The selected configuration proved to dampen the waves and control sedimentation (figure EA-2). The spending beach would be a part of the Federal project, and its shape and slope would remain as designed for the life of the project.

The city of St. Paul requested that some of the dredged material from the entrance channel and maneuvering basin be placed behind the detached breakwater to make fastlands. The proposed fill would be about 5 acres and use about one-third of the dredged material. The city planned to use the area for public harbor-related facilities.. Access to the site would be only by boat; a vertical dock was proposed to facilitate the loading and unloading of vessels.

The inclusion of the spending beach as part of the Federal project changed the city's planned use for the area. The size of the fill was decreased to less than 3 acres, and beach slopes would have required the construction of a pile-supported dock more than 200 feet wide.

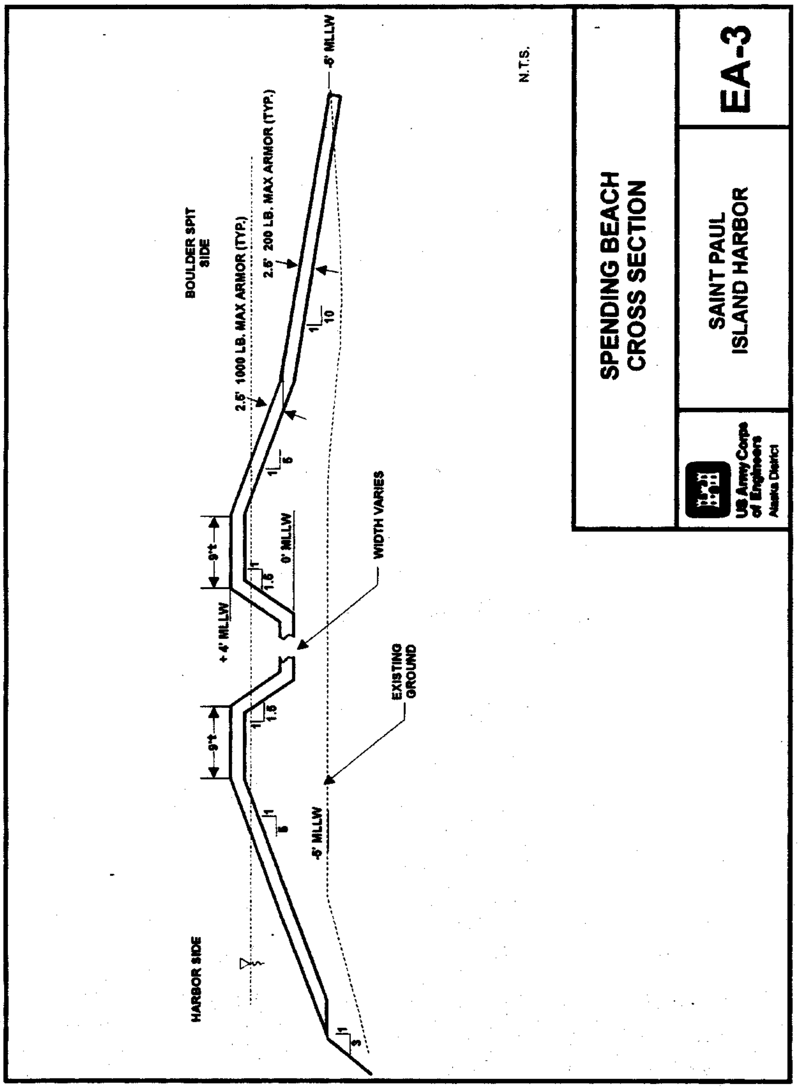
Revenue that would have been derived from renting storage space on the fill could not justify the expenditure required for a pile-supported dock that would have been wider than the dock at the Anchorage Harbor (a major port).

Before construction of the breakwaters, fur seals only infrequently used Village Cove. Since breakwater construction, the number of fur seal pups using Village Cove has increased, with approximately 300 fur seal pups present last summer. The flatter slopes of the proposed spending beach would be almost identical to the natural beaches used by fur seals on St. Paul Island. Although the likelihood of a fur seal rookery being established on the proposed spending beach is low, its use as a temporary hauling-out area is very probable.

A submerged or partially submerged spending beach is ideal for discouraging use by fur seals. The spending beach design attempts to discourage fur seal use by placing the top elevation at +4 feet MLLW, with the majority of the beach submerged during at least part of the tidal cycle. To further discourage seal use at the request of the city, the inside of the spending beach would be submerged (+0 feet MLLW) for almost all tides (figure EA-3).

The proposed spending beach design would ensure that the area wouldn't be used for fastlands without further environmental review.

2.3.2. Decrease Number of Storm-Generated Waves Overtopping the Main Breakwater. Overtopping occurs when sustained winds from the south or southwest in excess of 20 knots cause large seas to break on and over the main breakwater. Overtopping reportedly can range from a minor inconvenience of salt water spray on the dock and in the harbor to unsafe conditions when large amounts of seawater and debris are deposited on the dock and road. Overtopping causes a significant amount of damage and expense to public and private property, including road washouts and damage to vessels, docks, and processing barges. Overtopping


HARBOR SIDE
BOULDER SPIT SIDE
2.5' 1000 LB. MAX ARMOR (TYP.)
2.5' 200 LB. MAX ARMOR (TYP.)
-5' MLLW
N.T.S.
9'±
9'±
+4' MLLW
0' MLLW
-5' MLLW
WIDTH VARIES
EXISTING GROUND
SPENDING BEACH CROSS SECTION
SAINT PAUL ISLAND HARBOR
EA-3
US Army Corps of Engineers Alaska District

also causes saltwater spray damage to electrical panels, exteriors of buildings, and rolling equipment. Debris cast over the breakwater also must be cleaned up.

Sway created by wave energy transmitted through the breakwater damages vessels rafted together by parting moorage lines, breaking dock and vessel moorage cleats, and destroying bumpers. This wave energy adds to the wave heights in the harbor.

A two-dimensional model of the main breakwater was constructed in the Waterways Experimental Station in Vicksburg, Mississippi. The model was used to help determine the alternative that best reduced the overtopping and wave energy transmitted through the breakwater. The alternative also had to be sound from an engineering, environmental, and economic standpoint. The model was constructed by simulating the cross-section of the existing breakwater. Wave conditions were simulated by using previous water levels and wave periods (those used in the model for the original design) and new water levels and wave period information gathered since construction of the harbor.

The alternative designs were tested for performance levels, stability, and survivability at different water levels to represent extreme water. Wave periods were tested at 11-, 14-, 16-, and 20-second waves for the performance and stability tests. Four different basic cross sections were tested:

1. Overlay. The breakwater seaside slope was modified to 1:3 from the crest to the bottom of the toe with an overlay of armor stone.

2. Toe berm. The breakwater toe elevation was raised to +10 feet MLLW and extended out 100 feet, and the seaside toe slope remained the same at 1:1.5 from the breakwater bench to the bottom of the toe.

3. Single offshore reef. An offshore reef was constructed with a 110-foot crest width, 260 feet out from the breakwater. The crest elevation was set at -8 feet MLLW.

4. Multiple offshore reefs. Three parallel reefs were constructed beginning 170 feet offshore from the breakwater, each 70 feet apart with crest widths of 20 feet and crest elevations of -12 feet MLLW.

The single-reef and multiple-reef plans were the most effective alternatives (refer to table 1). The overlay and toe berm alternatives were not effective in reducing the overtopping of the breakwater (refer to Section 6, Model Studies, of the Hydraulic Appendix). The multiple-reef alternative was selected because it out performed all other alternatives, was less expensive to construct, and could provide rocky subtidal habitat for fish and marine invertebrates. The length and positioning of the offshore reefs were determined using the three-dimensional model to ensure no velocity currents were created at the entrance channel to the boat harbor.

The offshore reefs would require approximately 117,000 cubic yards (yd^3) of rock (75,000 yd^3 of armor stone and 42,000 yd^3 of bedding stone) and would cover approximately 9 acres of subtidal substrate.

Table EA-1.--Model results
(Water overtopping and wave energy transmitted through the breakwater, cubic feet per second per foot of breakwater length.)

	Wave Periods (seconds)			
	11	14	16	20
Existing Conditions	0.81	1.22	1.38	1.48
3 Offshore Reefs (selected)	0.10	0.05	0.12	0.08
Single Offshore Reef	0.07	0.04	0.08	0.23
Toe Berm	2.39	1.32	1.87	1.56
Overlay	1.02	0.27	0.67	0.15

2.3.3. Improve Water Circulation within Salt Lagoon. Construction of the main and detached breakwaters in 1989 decreased the amount of water entering Salt Lagoon during severe storms. Before construction of the breakwaters, large storm-generated waves crashed over the boulder spit and entered the entrance channel. Accompanying winds then pushed the water to the far end of Salt Lagoon. The wind caused water to remain in Salt Lagoon until the storm's intensity lessened. Construction of the breakwaters has prevented the large storm-generated waves from entering Village Cove and Salt Lagoon.

The previous environmental assessment indicated a reduction in storm-generated water entering Salt Lagoon, but the magnitude was not known. As part of the environmental uncertainties, the city of St. Paul was required to monitor Salt Lagoon environs. The results of the last study indicated water quality in Salt Lagoon had degraded, and that without change, Salt Lagoon would be significantly impacted.

The proposed action also would include construction of a wave energy channel outside the existing detached breakwater through the boulder spit (see figure 5 in the main report). The wave energy channel's preliminary design is at +2 feet MLLW and is 100 feet wide. The sill of the wave energy channel would allow only storm-generated water into Salt Lagoon. Storm-generated water would enter the wave energy channel (a lesser quantity would also enter through the natural entrance channel), and wind setup would push the water to the back of Salt Lagoon. When the storm lessened, the water would exit Salt Lagoon through the natural channel because the wave energy channel is at a considerably higher elevation (the invert of the natural entrance channel is at -3 feet MLLW). The exact configuration of the wave energy channel has not been determined. Concerns about wave energy channel design include currents that now enter Village Cove harbor and least auklet nesting habitat that would have to be removed to open the energy channel through the boulder spit and into Salt Lagoon. After constructing the wave energy channel, the removed boulders would be built up along the channel in the same configuration as the existing boulder spit. There would be a quantitative gain in boulder spit habitat; however; the quality of the constructed habitat cannot be predicted.

Representatives from the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) will assist in the design of the wave energy channel during the preconstruction engineering and design phase of the project. Representatives from USFWS, NMFS, and Alaska District biologists and hydraulic engineers will physically manipulate the wave energy channel in the three-dimensional model until all parties concur with the design. The wave energy channel would be built before any other part of the project. Water circulation patterns in Salt Lagoon as well as least auklet nesting behavior toward the man-made berm would be monitored during project construction. This would allow for changes in configuration prior to project completion.

It should be noted that the harbor improvements, construction of the offshore reefs and spending beach, and dredging the harbor entrance channel and maneuvering basin would not affect the circulation, water quality, or other resources of Salt Lagoon.

2.3.4 Dredging and Disposal Operations. Approximately 350,000 yd^3 of sand, gravel, and boulders would be removed to reach the project depth and width. The material's grain size excludes use of a cutterhead suction dredge. Instead, the material would be removed by a crane-mounted bucket dredge, a barge-mounted excavator, or a similar bucket dredge. The dredged material would be placed in a barge and taken to one of the dock facilities in the harbor. The material would then be loaded in dump trucks and taken to the city's landfill where it would be stockpiled. The city would use the dredged material in their landfill operations (layering, capping, etc.). The city of St. Paul agreed with the State of Alaska, Department of Natural Resources, the owner of the dredged material, that it would be used only for public projects.

2.4 No-Action Alternative

With the no-action alternative, severe winter storms would continue to damage the road, Unisea processor, boats, and other harbor facilities. Present procedures for safe vessel operation in and out of the harbor would prevail, and the harbor would not be run in the most efficient manner. The no-action alternative would delay any restoration of Salt Lagoon water circulation.

The harbor is now used by vessels considerably larger than anticipated. The harbor size limitation for larger vessels increases the likelihood of vessel accidents. Vessels running aground, or striking another vessel or dock, could spill fuel and damage the environment. The proposed harbor improvements would reduce the potential for harbor accidents. This would reduce the potential for an accidental fuel spill. This would be considered a positive effect.

2.5 Other Alternatives

Alternative designs for dredging depths, overtopping reduction structures, and spending beach construction were evaluated for engineering, environmental, and economic considerations and are discussed in section 3 of the main report.

3. ENVIRONMENTAL SETTING

3.1 Physical Environment

3.1.1 Climate. St. Paul Island is at latitude 57° 10' North, and longitude 170° 15' West in the central southeast Bering Sea. The community is on the shore of Village Cove on the south side of the island. The climate is typically maritime, resulting in cloudiness, heavy fog, high humidity, and relatively narrow daily temperature ranges. The difference between the average daily maximum and minimum temperatures for the entire year is only slightly more than 7 °F, and the greatest monthly variation (March) is slightly less than 12 °F. Temperatures remain cool even during the summer; the highest temperature on record is 64 degrees. Although the record low temperature is below zero, such extremely cold temperatures are rare. Temperatures fall below zero an average of only 5 days per year.

3.1.2. Tides, Currents, and Storms. Tide levels at Village Cove are shown in table 2. Extreme high tide levels result from the combination of astronomic tides and rises in local water levels due to atmospheric and wave conditions.

Table EA-2.--St. Paul tide levels (feet)

Highest Tide (Estimated)	+6.0
Mean Higher High Water (MHHW)	+3.2
Mean High Water (MHW).	+3.0
Mean Sea Level (MSL).	+2.0
Mean Low Water (MLW)	+1.0
Mean Lower Low Water (MLLW)	0.0
Lowest Tide (Estimated)	-2.5

Source: NOAA Tide Tables, 1980.

Village cove is directly exposed to deep-water waves approaching from the west and southwest sectors, with an exposure window bounded by azimuths 210° and 294°. There is some wave refraction with storms from the other directions, but the refraction is not significant enough to cause high waves within Village Cove.

Current patterns in Village Cove were simulated in the three-dimensional model for -32 feet MLLW dredging depths and stated channel width and for all the spending beach alternatives. The results of these simulations are in the Appendix A, Hydraulic Design. The water's current pattern is to enter Village Cove through the harbor entrance channel and the gap between the boulder spit and the detached breakwater. Sediment (simulated using coal dust) mainly enters through the gap between the detached breakwater and boulder spit, where it encounters an eddy created by the inverted shape of the spending beach. This eddy allows the majority of the suspended material to fall out within the spending beach indentation. The remainder of the material follows the spending beach shoreline where the material settles out in the middle of Village Cove, away from both the entrance to Salt Lagoon and the local native corporation's dock facilities (figure EA-4).

Water column circulation is simulated using dyes. This is the best representation of water circulation throughout the water column. The current was strongest through the gap between the detached breakwater and boulder spit. The dye followed a clockwise direction once past the spending beach. There were no "dead areas" within the harbor. Tidal velocities were relatively low during normal wind and wave action. High wind and wave action increased water velocities as expected. The areas of highest velocities occurred at either end of the detached breakwater (figure EA-5).

3.1.3 Water Quality. Water quality is a primary determinant of the biological use of an area, and it is likely that the distribution of water quality characteristics may be reflected in the biota distribution. The harbor contains three fish processing facilities, three fuel docks, and no other industry. The processors discharge all their wastes through a pipeline to East Landing, where the pipes daylight about 900 feet off shore at a water depth of -26 feet MLLW. Crab is processed at all the facilities, with some snail and halibut processing at the Unisea facility. All three facilities take their processing water from Village Cove.

The fuel docks distribute diesel fuel only; no bunker fuel is available. To date, there have been no major fuel spills; less than 100 gallons have been lost since the breakwaters were built.

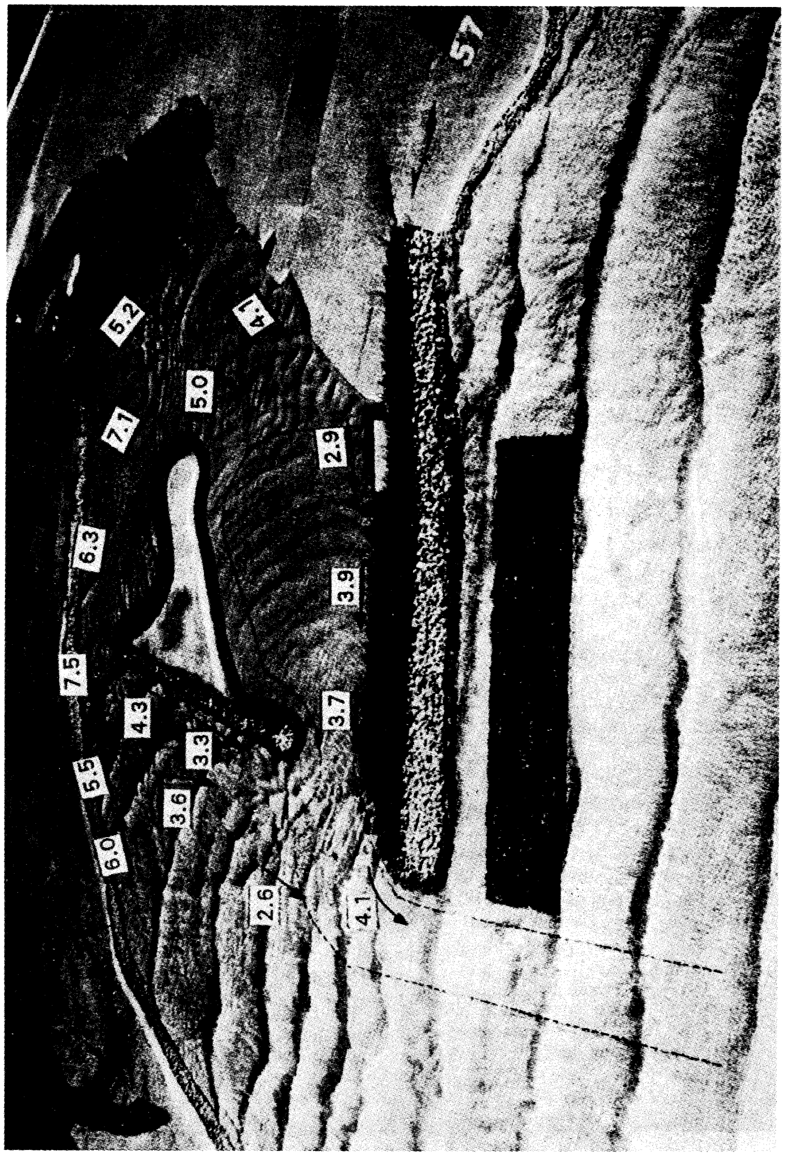


FIGURE EA-4.--Typical current patterns in Village Cove (from 3-D model study).

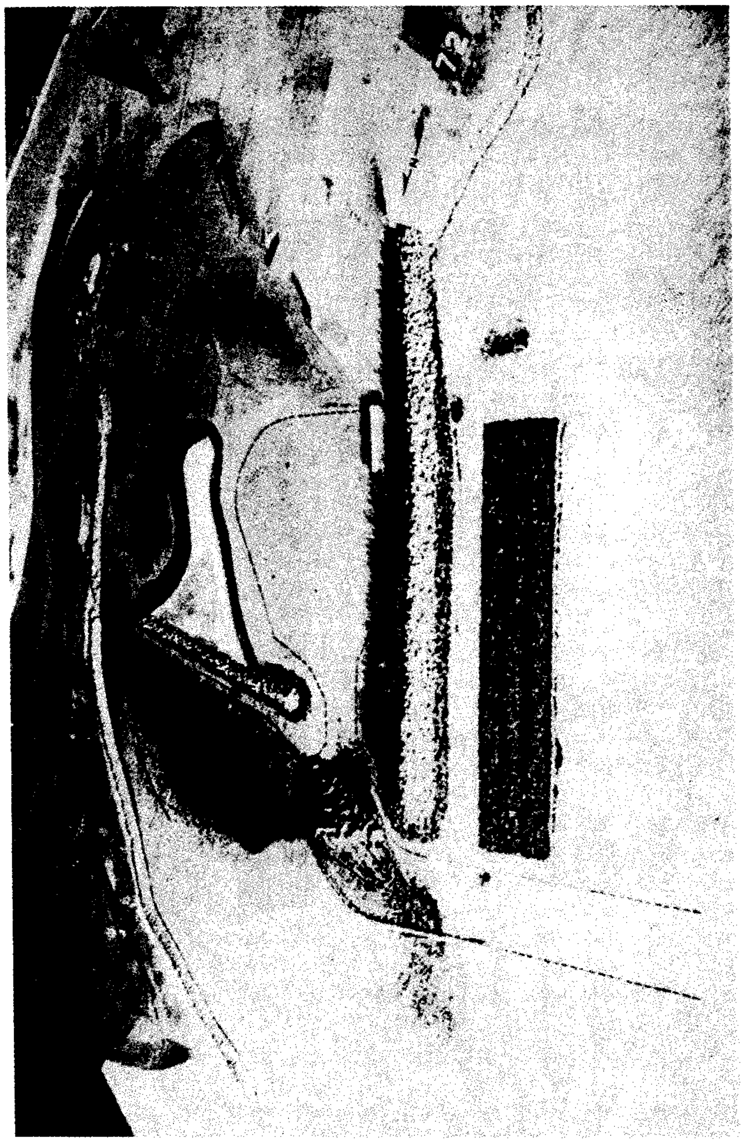


FIGURE EA-5.--Areas of highest water velocities in Village Cove (from 3-D model study).

Oil pollution is a general name for a variety of hydrocarbon compounds having widely differing physical and chemical properties. At St. Paul, the main concerns would be with diesel fuel and oily bilge water. Oily substances harm fishes and other aquatic organisms. The adverse effects of oil on aquatic life are as follows:

1. Oil and its emulsions adhere to the gills of fishes and interfere with normal respiration. Under conditions of relatively mild pollution, the mucus produced by fishes may wash away the oil. However, with heavy pollution, the oil cannot be washed away and tends to accumulate on the gills.

2. Oil and emulsions of oil and water can coat algae and other plankton and thus destroy them. These plants are a source of food for fish. The destroyed organisms tend to clump together, settle to the bottom, and decompose.

3. Oil and oily substances that settle may coat the bottom of a natural body of water. Benthic organisms are destroyed and potential fish and invertebrate spawning habitat is destroyed.

4. Oils, which contain soluble materials along with emulsified components, may be eaten by fish. The flavor of the fish flesh may become tainted and thus not marketable.

5. If there is significant oil pollution, it acts like any other organic substance and tends to deoxygenate the waters; if deoxygenation is severe, fish will be killed.

6. If the oil coating is fairly thick on the water surface, it can interfere with aeration of the body of water at the air-water interface. The coating may also interfere with photosynthesis. Tests have indicated that light films of oil are not detrimental to aeration or photosynthesis.

7. All oils, even those that are highly purified, contain water-soluble materials that can directly poison fishes or fish-food organisms. In some instances, the materials are toxic enough or in large enough amounts to cause immediate death. With other oily materials, slow death or disability may result. Chronic toxicity implies an effect over a long period of time. This effect may result from cumulative action of the toxicant or from subthreshold changes in the environment. This type of effect is extremely difficult to document and is probably more injurious than a larger spill, which causes immediate kills.

St. Paul harbor would contribute to oil pollution. The sources would be the refueling operation, oily bilge wastes, outboard motors, and other petroleum-related uses. The amount of pollution that occurs in a harbor is directly to related to the types of regulations in place and their enforcement. Even with strict enforcement of stringent regulations, accidental fuel spills occur. This is evident at any existing boat harbor, where periodically a visible oil sheen coats the water surface. The water exchange between Village Cove and the Bering Sea appears to be adequate to keep the harbor area clean in conjunction with enforcement of regulations.

The capstones on the spending beach could serve as an anchor for an oil boom, which could attach to the boulder spit. A boom would help reduce the amount of oil that would enter Village Cove and Salt Lagoon from a spill outside the harbor.

Sewage and garbage (foodstuffs) that could enter the harbor would be either from boats or from servicing boats. This form of organic pollution tends to deplete the oxygen of receiving waters, both in the immediate vicinity and (in this case) possibly in Salt Lagoon. This enriched productivity could overload the natural assimilative capacity of the environment, and a zone of degradation, decomposition, and low oxygen conditions would be created. While primary productivity may be extremely high under these conditions, secondary productivity is often low because the kinds of algae (primary productivity) are often unsuitable as food for grazing animals. As with oil pollution, the enforcement of regulations would be the deciding factor in determining to what extent pollution would occur.

In summary, harbor improvements could increase traffic into Village Cove. The city of St. Paul, through the harbor master's office, has been able to maintain good water quality in Village Cove through enforcement of the regulations.

3.2 Socio-Cultural Environment

3.2.1 Cultural Resources. During the Wisconsin glaciation, which ended 10,000 years ago, the Pribilof Islands were covered with ice. The islands would have been part of the Bering Land Bridge, the 500-mile-wide corridor that made initial settlement of the New World possible. However, they have long been considered devoid of prehistoric remains because they were uninhabited when they were discovered in 1787 by Gerassim Pribilof. Following their discovery, the Russians relocated groups of Aleuts to the islands to work in the fur trade. American military history on both St. Paul and St. George Islands begins in 1870, when a detachment from Fort Kodiak was sent to enforce fur seal harvest regulations. St. Paul was home to a Signal Corps facility beginning sometime before 1880. During World War II, Aleuts were evacuated to Admiralty Island, while a small military contingent remained behind to establish a LORAN station and to mine the village in case of enemy attack.

The potential for cultural remains predating 1787 is low, for reasons mentioned above. Parts of the islands have been surveyed over the years, beginning with the finding of 13 sites on the two islands (Bryan 1966). The Alaska District has surveyed parts of St. Paul twice, in 1979 and 1985, in conjunction with the small boat harbor and with the World War II cleanup project. The 1979 survey located a few house pits near the small boat harbor site, but they were not close enough to be affected by harbor construction. The 1985 survey located an inland site and took note of the

Kaminista Ridge quarry site, which had already been established. Copies of both survey reports are on file with the State Historic Preservation Officer (SHPO) and with Alaska District personnel.

The Pribilof Islands together constitute the Fur Seal Rookeries National Historic Landmark and are therefore listed in the National Register of Historic Places. Through consultation with the SHPO, a finding of No Effect to the Landmark has been reached. In the unlikely event that additional cultural resources were located during the construction of the project, they would be evaluated in consultation with that office.

3.2.2. Public Participation. A public scoping meeting was held on St. Paul Island on January 10, 1996. The meeting participants generally accepted the project, but they were concerned with the development of Village Cove and the rate at which the village is growing. The local citizens fear a situation similar to Unalaska (only one Native on the city council). The beach at the head of Village Cove is used by both children and adults on sunny, relatively warm days.

The fill behind the detached breakwater (not the spending beach) was part of the proposed action at the time of the public meeting. A concern that direct access from the mainland to the fill would eventually be constructed was discussed at length. As with the resource agencies, the public expressed concern about potential impacts to the lagoon entrance channel and the boulder spit if a bridge or causeway were constructed. All other comments supported the project. The overtopping of the breakwater by storm waves was a major concern. Other comments included the need for a small boat harbor for local vessels and positive benefits of the offshore reefs for subsistence fishing.

A second public scoping meeting was held in Anchorage on January 24, 1996. The spending beach design was completed and presented at the meeting. Preservation of Salt Lagoon and the Village Cove area was a concern. The local Native corporation was concerned with the potential for increased wave heights at their dock facilities and with the project-induced currents carrying material into their newly dredged basin. There were no comments opposing the proposed harbor improvements from an environmental or a cultural perspective.

3.2.3 Coastal Zone Management. St. Paul, Walrus, and Otter Islands are the three most northerly of the Pribilof Islands, and comprise the land area within the Saint Paul Coastal District. The city of St. Paul finalized the St. Paul Coastal Management Program (CMP) in 1988. The district boundaries enclose all territory contained within the perimeter of a 3-mile line surrounding the mean low water line around Saint Paul, Walrus and Otter Islands. All land and water within the district is within the coastal zone, as described in *Biophysical Boundaries of Alaska's Coastal* Zone (Department of Fish and Game).

The CMP restricted future development on Saint Paul Island to the Village Area, Harbor District and the Development Corridor. The proposed action is within the Harbor District. The goals established in the CMP for the Harbor District are:

1. To provide land within the harbor district for water-dependent uses.

2. To provide access and use of landing areas for local residents' small-boat day fishery.

3. To adhere to a harbor development plan to the extent feasible and prudent.

4. To provide infrastructure to support services required to meet existing and future harbor development.

5. To provide a safe harbor of refuge for the fisheries industry within the Central Bering Sea.

6. To accommodate the needs of both the day fishery and the larger commercial fishery.

7. To the extent feasible and prudent, assist private enterprise in economic development within the harbor area that results in increased employment for local residents.

The CMP also established environmental goals and objectives. The environmental goals are:

1. To ensure protection, maintenance and enhancement of the natural environment by establishing high quality standards for soils, vegetation, air and water quality, sound, sight and wildlife, and with appropriate surveillance and enforcement procedures.

2. To protect wildlife and habitat resources.

3. To protect areas traditionally used for subsistence activities.

4. To protect reindeer grazing areas.

5. To protect Walrus and Otter Islands from land use or development other than those related to resource management and enhancement or subsistence use rights.

The proposed action is within the Harbor District and is totally water related. The dredged material would be taken to the landfill where it would be used for layering and capping of the solid waste generated on the island. The proposed Federal action is consistent, to the extent practicable, with the Saint Paul Coastal Management Plan and the State of Alaska Coastal Management Program.

4. BIOLOGICAL ENVIRONMENT

4.1 Intertidal/Subtidal Marine Habitat.

The portion of boulder spit outside the breakwaters is a high-energy open coast environment usable only by marine life with the best attaching mechanisms. The 1982 EIS discussed two species of algae and one periwinkle species as being almost exclusive along the spit. It further stated that the decrease in wave climate caused by the construction of the breakwaters could change the species abundance and possibly the species composition. No subsequent surveys have been performed to substantiate the prediction.

Village Cove is a productive system, especially with the nutrients being supplied by Salt Lagoon. Villagers have reported that there is an abundance of small herring-like fishes in Village Cove near the mouth of Salt Lagoon during the summer months.

The bottom substrate of Village Cove from the head to the proposed entrance channel is composed of sands and gravel with large round rocks interspersed. The round rocks make dredging difficult. Local interests have dredged approximately 200,000 yd^3 from Village Cove in the last 4 years. The material appears to be homogenous vertically; the bottom composition is the same after dredging 10 feet down. The proposed dredging of the entrance channel, maneuvering basin and the 5-acre (bottom footprint) fill would have only minor adverse effects to the subtidal habitat in Village Cove.

4.2. Potential Impacts on Resources of Concern.

4.2.1. Seabirds. Eleven species of seabirds return to the Pribilof Islands annually to nest and rear young. The majority of the world's population of red-legged kittiwake nest in the Pribilofs. An estimated 250,000 seabirds are found on St. Paul Islands, nesting on cliffs and in burrows (USFWS 1996).

The proposed harbor improvements project could directly affect the least auklet nesting habitat on boulder spit and indirectly affect all seabirds on the island if rats were introduced to the island by freighters and other large vessels.

Least Auklet/Boulder Spit Habitat. Resource agencies and some island residents were concerned about creating an island behind the detached breakwater. The original design of the proposed project included a 5-acre fill behind the detached breakwater. The fill was planned to be at +12 feet MLLW, and mainly would have been used for storing fishing and fishing-related equipment. Access to the island would have been by boat only; a dock was planned on the west side of the fill. However, with the shortage of waterfront harbor space, the resource agencies believed a commercial facility would have been constructed on the 5-acre fill in the near future. The commercial facility would have required utilities and direct access to the shore. The only feasible access would have been a fill or bridge across the Salt Lagoon entrance channel, a connecting road parallel to boulder spit, and a bridge or fill from the boulder spit to the island. The road would have impacted boulder spit and least auklet nesting from the Salt Lagoon entrance channel to the bridge or fill access to the island. The road also would have provided access to the now fairly inaccessible boulder spit. Access to the boulder spit now is by boat, by walking across the tidelands, or by a longish walk after a several mile drive on a two-rut road.

Redesigning the spending beach diminished the probability of the beach being developed for commercial use. The slopes of the spending beach and the exclusion of any vertical surfaces in the harbor would make boat access difficult. It would require a 200-foot- wide pile supported dock to reach water depths sufficient enough to dock vessels. The spending beach design has reduced the usable area from 5 acres to less than 3 acres. Also, the area, except for the perimeter, would be either subtidal or intertidal. This not only would add to the expense of developing an island, but would require public review of the proposed action.

Seabirds/Rat Introduction. The Pribilof Islands are rat free. Introducing rats to St. Paul Island could have severe adverse impacts to seabird populations throughout the island. Rats would be able to climb the seabird nesting cliffs, destroy the nests, and eat the eggs. Rats could also maneuver through the small voids on boulder spit where least auklets nest.

Several mechanisms are in place (both natural and planned) to combat the establishment of rats on the islands. The Pribilof Islands are at the northern range for rats. Russian explorer Gerassim Pribilof discovered the islands in 1787. Russian and other traders have visited the Pribilof Islands regularly since their discovery. The U.S. military, the Signal Corps, U.S. Coast Guard, and NMFS have occupied St. Paul Island through some part of the island's history. The shipping of goods to the island and the export of fur seal pelts have occurred throughout the occupation of St. Paul Island. The fishing industry has used St. Paul for staging for the past few decades. Many of these vessels must have contained rats. However, large vessels did not dock on St. Paul Island until the construction of the breakwaters and docks. Although rats can swim, it is unlikely they could swim from a vessel anchored over one-quarter-mile off shore in the cold Bering Sea waters and survive. The most likely mode of rat introduction to the island would be from lightered cargo or ship wrecks. Several vessels have gone aground on or near St. Paul Island. If these vessels had contained rats, access to the island would either come directly from the ship to shore or on vessel wreckage washed ashore.

Since there are no rats on the island, either the rats have never made it to the shore, or they have not survived once on shore. There could be many reasons for their absence, and it is possible that rats cannot survive on the island, which is out of their habitat range. Another strong possibility is predation by arctic fox. Arctic fox are abundant on the island and could be a natural defense against rat establishment. Arctic fox have colonized the main breakwater and may assist in eliminating rats that come ashore from vessels at the docks. Again, this is only speculation.

The probability of rats on board larger vessels is higher than the probability of rats on board vessels that currently call at St. Paul harbor. The city of St. Paul has agreed to establish a rat protection plan with the U.S. Fish and Wildlife Service to reduce the likelihood of rats coming off larger vessels that would call at the harbor if the proposed action is constructed. Since only three or four freighters would be entering the harbor yearly, an active rat protection program should be established for every freighter that uses the docks. The vessels could be watched while an inspection of the vessel is performed. The harbor master could turn away rat infested vessels or could require 24-hour watch while the vessel is loading. The potential for freighters to introduce rats to the island is serious, and the city of St. Paul, with the guidance of the USFWS will take every practical measure to ensure this does not happen. The city of St. Paul already has a rat protection program which consists of 150 rat traps in the following locations:

Harbor Area:	114 stations plus 10 inside the Trident plant, 11 inside the Old Unipak plant. Stations are also on the Arctic Star (Icicle Seafood's processor ship) and the UniSea barge.
Garbage Dump:	10 stations
POS Camp:	8 stations

Vessels are also turned away from docking if the presence of rats is suspected. The new protection plan may use more active rat protection, such as inspections, for freighters and catcher processors.

4.2.2 Fur Seals. Seventy-five percent of the world's population of northern fur seals establish harems and pup on the Pribilofs at established rookeries scattered around the islands (USFWS 1996). Several fur seal rookeries are near the harbor but appear to be far enough away so that no direct harbor activities would impact them.

The number of fur seals using the harbor has increased since the construction of the breakwaters. An estimated 300 fur seal pups were observed in the harbor in the summer of 1995. They are mainly observed at the back of the harbor near the entrance to Salt Lagoon. They exit the water on the beaches adjacent to boulder spit.

Construction of a spending beach with slopes and composition similar to the other fur seal rookeries on the island, coupled with Village Cove being an historical rookery, may lure additional seals into the harbor. Additional use of the harbor by fur seals would increase the fur seal-human conflict. It would be better to prevent fur seals from becoming established on the spending beach than to try to implement a change later if fur seal-human conflict became intense. The Alaska District has changed the design of the spending beach to discourage use by fur seals by limiting beach habitat. The proposed spending beach would be an intertidal structure except for the 1\2-ton cap stone that would be placed on the beach to +4 feet MLLW. The inside of the spending beach foot print would also be intertidal, with an elevation of +0 feet MLLW. The spending beach would be available for fur seals to haul out on for only a limited time.

The dredging of the entrance channel and maneuvering basin and the placement of the offshore reefs would not affect the fur seals. Construction of the breakwaters and dredging sections of the inner harbor by local interests have had no apparent effects on the fur seals or their behavior. The increased size of vessels using the harbor should not cause any impacts to fur seals or their habitats.

The city and NMFS have agreed to jointly develop a management program for fur seal use of the harbor area.

4.2.3 Salt Lagoon. Salt Lagoon, with its associated intertidal areas and wetlands, is the only salt lagoon on St. Paul Island and in the central Bering Sea area. A species of dunegrass and a member of the parsley family are dominant vegetation along the lagoon's periphery.

Polychaetes and grammarus amphipods compose the most abundant species of the intertidal and subtidal organisms of Salt Lagoon. These invertebrates are a food source for many species of fish and for water-oriented birds. Salt Lagoon provides primary and secondary productivity, which is probably important to the biota even outside the immediate area. Migrating waterfowl and many species of shore birds use Salt Lagoon during the summer months. USFWS observed approximately 300 red- and black-legged kittiwakes roosting on the Salt Lagoon mudflats in September 1995 (USFWS 1996).

The city of St. Paul had Salt Lagoon monitored as part of the Harbor Management Plan associated with the construction of the breakwaters. The studies from 1988 to 1991 did not indicate a significant change in Salt Lagoon environs. The "Russian Study" (Flint and Rybnikov 1994) indicated that water circulation and flushing in Salt Lagoon were insufficient to maintain the present ecosystem. The report discussed several chemical pollutants that generally indicate eutrophication. The study further stated that immediate action should be taken to reestablish the water quality in Salt Lagoon. The study recommended widening and deepening the entrance channel to prevent further degradation.

The numerical model performed with the original project indicated that only a four percent decrease in tidal flow between Village Cove and Salt Lagoon would occur with the construction of the breakwaters. Although no tidal studies have been performed since construction of the breakwaters, the model appears to be fairly accurate (refer to appendix EA-3). Construction of the breakwaters has almost eliminated movement of water into the lagoon from storm-generated waves. Although enlarging the entrance channel would increase circulation in Salt Lagoon, the magnitude would be small, four percent at best. The wave energy channel would introduce a large amount of water into the system in a relatively short period of time. With wind setup, complete water exchange would occur. This would happen on an average of 5 or more times per year.

4.2.4 Threatened and Endangered Species. Threatened and endangered species coordination was conducted during the 1982 EIS, the 1987 and 1988 environmental assessments, and with the proposed action.

Although several species of endangered whales are present in the Bering Sea, none occur with the nearshore waters of St. Paul Island. The threatened Stellar's sea lion hauls out on other islands in the Pribilofs, but is not present on St. Paul Island. The proposed action would not affect these species or their critical habitat.

Stellar's eiders are proposed for listing as threatened under the Endangered Species Act. They are present in the waters surrounding the Pribilof Islands during winter months. This species is not present in the Village Cove area.

Red-legged kittiwakes, the Pribilof shrew and one plant species, *Artemisia globularia lutea* are listed as Species of Concern. A Species of Concern is one that is declining in numbers, but there is not sufficient biological information to warrant consideration for listing.

The proposed harbor improvements are concentrated in the Village Cove area. Neither the plant species nor the Pribilof shrew have been identified in the Village Cove area. The red-legged kittiwake is regularly seen in Village Cove and Salt Lagoon. The proposed action, including the construction phase should have little effect on this gull species. None of the habitat used by the kittiwakes would be destroyed.

5. SECONDARY AND CUMULATIVE IMPACTS

Secondary impacts are always difficult to assess. The 1988 EA stated in the secondary impacts section: "There has been no indication that any new projects are being established because of the proposed activity outlined in this report".

The community has approached the Alaska District for assistance in the construction of a small boat harbor for the local fishing fleet. The small boat harbor would be on the southwest portion of Village Cove (EA-2). The boat basin has already been dredged (as permitted by Corps of Engineers 404 permit Bering Sea 62) to -12 feet MLLW and would accommodate about 30 vessels. If there was Federal involvement in this boat harbor, it would be to provide breakwater protection and an entrance channel from the boat basin to deeper water. Federal interest in this project has not yet been determined.

The Alaska District will measure current velocity in the area of the proposed boat harbor during the Salt Lagoon wave energy channel model study. Water exiting Salt Lagoon after a storm could have increased velocities and/or wave heights at the proposed boat basin. Since a boat harbor in this location is a strong possibility, whether there is Federal interest or not, water velocities at the proposed boat basin site will be a part of the sizing of the energy channel.

The local Native corporation has conceptual plans for Village Cove. These plans include the beach area at the head of the cove and along boulder spit. The proposed harbor improvements would assist the Native corporation in reaching their goals. However, even if the proposed action was not completed, the Native corporation probably would still pursue their goals.

Dredging associated with the proposed action, coupled with dredging already completed and still proposed in Village Cove by the Native corporation, constitute cumulative impacts. The actions have changed, and probably will continue to change, a relatively shallow sand, gravel, rock substrate to a deeper substrate of the same composition. Dredging also allows larger vessels to enter the harbor. These larger vessels contain more fuel, which could lead to a catastrophic spill.

6. QUARRY EVALUATION

The Alaska District policy is to not designate rock quarries for civil works projects. The construction contractor is responsible for providing rock for the project. The rock must meet physical requirements, and quarry operations and expansion must follow environmental criteria. If the construction contractor selects a quarry that is not defined as existing, all environmental analysis must be accomplished before any quarry work is started. Since a contractor must complete the project within a set period of time (starting from the award of the contract), any extended delays in quarry and quarry facility authorization cause the contract completion date to not be met. Liquidated damages (usually monetary) accompany failure to meet the contract completion date.

Impacts expected from an existing quarry depend on the characteristics of the surrounding area, the site, the method of operation, the length of time of operation, and many other factors. By assuming the use of an already existing quarry as a rock source, however, a large portion of potential impacts are avoided that could be severe if an undeveloped area were opened for quarry use. Impacts expected from using an existing quarry can be classified into six categories based on activity: blasting, burning, clearing, processing, solid waste disposal, and grading/plowing. Table 3 shows the relationship between the operations and the environmental resources of interest. An "X" implies that interaction between the resource of interest and the operation could result in an impact; a "#" indicates that the potential impact is not relevant to that resource category; and a blank space indicates no impact.

Table EA-3.-- Relationship of quarry operations to selected natural resources

RESOURCE	QUARRY OPERATIONS Blasting	Burning	Clearing	Mineral Processing	Solid Waste Disposal	Grading or Plowing
Marine Mammals						
Beluga Whale	X	#	#		#	#
Bowhead Whale	X	#	#		#	#
Harbor Seal	X	#	#			
Pacific Walrus	X	#	#			
Polar Bear		#	#		X	#
Ringed Seal	X	#	#		#	#
Sea Otter	X	#	#		#	#
Steller Sea Lion	X	#	#		X	
Terrestrial Mammals						
Brown Bear	X	X	X		X	X
Black Bear	X	X	X		X	X
Dall Sheep	X		X	X		X
Furbearers	X	X	X	X	X	X
Moose	X	X	X			X
Sitka Blacktailed Deer	X		X	X		X
Birds						
Bald Eagle	X		X	X	X	X
Ducks		X	X	X	X	X
Geese	X		X			X
Sea Birds	X			X	X	
Trumpeter Swan				X	X	X
Water Disturbance						
Silt/Sedimentation	X		X		X	
Shock Wave	X					
Water Pollution						
Suspended Sediment	X		X			
Oil Fuel Spills				X		
Land Surface Disturbance						
Vegetation Clearing/ Destruction		X	X			
Slash/Overburden		X	X			
Overburden/ Erosion			X			

X = Interaction between the resource and the operation could result in an impact.
# = The potential impact is not relevant to this resource category.
A blank space indicates no impact.

6.1 Resources of Concern.

The operation and small-scale expansion of a quarry may cause impacts to highly valued habitat types, species, or institutional holdings that could preclude use of the site. A list of 14 "Resources of Concern" was developed through discussions between the Alaska District and the U.S. Fish and Wildlife Service. This list was designed to indicate those resources which, if threatened with impact from quarry use or expansion, would remove the quarry site from consideration until a detailed, site-specific environmental review could be accomplished. Following is a list of the "Resources of Concern" which, if present, would require additional environmental review. This list is not meant to be all-inclusive.

Resources of Concern in Quarry Operations

Anadromous Fish Streams

Areas Meriting Special Attention
(as defined by the Coastal Zone Management Act)

Bald Eagle Nests

Critical Habitat (as defined by Alaska Statute Title 16)

Historic and Prehistoric Areas

Marine Mammal Breeding and Haul-Out Areas

Rare or Endangered Species

Sea Bird Rookeries

State or National Parks, Refuges, or Monuments

Wetlands (including inter and subtidal habitats) and Flood Plains

Wild and Scenic Rivers

6.2 Geology.

Quarries are generally accepted as open-cast excavations from which fairly massive and deep deposits of hard or soft rock are extracted. The excavations are fairly deep and tend to work progressively outward and downward. For ease of working they are often on an escarpment or hillside, but they can be on hilltops or on flat land. Each requires a slightly different technique and working sequence. Stone quarries usually have deep pits and little overburden.

Once an area has been committed to a quarry, these methods of operation could aid reclamation:

1. Restore the site to the original or similar condition as quickly as possible.

2. Design working methods to take as little of the most valuable land at one time as possible.

3. Concentrate extraction into large units in areas where conflicts with other land uses are less severe or absent altogether.

6.3 Surface and Ground Water.

Runoff from disposal sites and the quarry area can contain significant amounts of sediment. Levels of suspended solids in watercourses are categorized in terms of harm to fisheries as follows: 25 milligrams per liter (mg/L) solids - no harm; 26-80 mg/L solids - some harm; 81-400 mg/L solids - extensive; 400+ mg/L solids - severe.

In many pits and quarries, processing water and/or runoff water from operations that contain sediment is passed through settling lagoons before it is recovered or allowed to enter watercourses.

The development of sub-watertable operations in large quarries means that large quantities of water may have to be pumped away from the excavation. This water may contain significant levels of sediment. In addition, the quarry may affect the ground water flow; this is particularly important in limestone aquifers.

An additional source of water pollution from mineral extraction is the contamination of runoff and streams from spills of fuel oils, lubricants, detergents, etc., from fixed and mobile plants. These are not often a major hazard, however, and can be controlled by careful drainage and containment around likely trouble spots. A fuel spill contingency plan would be a likely requirement at any existing quarry, as would a sewage and wastewater plan.

6.4 Aquatic Environment.

The aquatic environment in an existing quarry area could be subject to water pollution as stated above. Stream channelization and the construction of roads requiring culverts have the potential to affect aquatic environmental quality.

6.5 Vegetation.

Vegetation would be cleared and the topsoil stockpiled for future revegetation at most quarry sites. The vegetation would be either removed by machinery or burned. Timber could be harvested and sold. The lack of vegetative cover can increase erosion and greatly increase the sediment runoff. Sidehill excavations are not conducive to revegetation, and quarry sites that are continually active may not be revegetated.

6.6 Wildlife.

Quarry operations displace wildlife from the area. The change of habitat, lack of vegetation, noise, and land-altering activities are usually too disruptive for wildlife within a certain radius of the facility. Adjacent habitat may not be fully used because of disturbances caused by noise and the proximity of people.

6.7 Air Quality and Noise.

There are no defined nuisance levels for dust and particulates, but emissions can be subject to control limits. Dust deposition, however, can harm vegetation; dust particles block leaf pores and affect rates of gas exchange in the leaf, which can make the leaves more susceptible to other forms of gaseous pollution. Major sources of dust pollution in quarries and the control measures possible for them are listed in table EA-4.

Table EA-4.--Major sources of dust pollution in pits and quarry workings, and possible remedial measures

DUST SOURCE	CONTROL MEASURES
Drilling	1 Collect dust by dry cyclone and filters 2 Suppress dust by water and/or detergent
Blasting	1 Suppress dust by water sprays 2 Consider expected atmospheric conditions before charging and blasting
Loading and Unloading	1 Suppress dust by automatic or manual water sprays (with detergent) 2 Enclose loading or unloading area, where practicable
Mobile Equipment	1 Surface internal roads 2 Direct exhausts upward 3 Suppress dust by water sprays and additives 4 Collect dust by road sweeper 5 Choose a different route 6 Cover loads of fine material
Fixed Plant (crushers, screens, conveyors, etc.)	1 Enclose machinery 2 Suppress dust by water sprays 3 Use collectors (bag, wet or dry centrifugal, electrostatic, etc.)
Dust Blow	1 Enclose stockpiles 2 Revegetate waste dumps 3 Suppress dust by water sprays 4 Collect dust by road sweeper

Noise levels outside the quarry site may become a nuisance to nearby people and to wildlife. Blasting vibration and air and water blasts can also constitute a nuisance, and may cause minor damage to buildings and adversely affect wildlife. Banks, barriers, and screens around the quarry, plant, and major vehicle routes greatly reduce any nuisance from noise and vibration. Careful siting and shaping are necessary for the noise barrier to be effective. The major sources of noise and their control measures are listed in table EA-5.

Table EA-5.–Major sources of noise and vibration in pits and quarry workings, and possible remedial measures

SOURCE	REMEDIAL MEASURES
Air Blast	1 Cover detonating fuse with dust, chipping, etc.
	2 Use low-energy detonating fuse or eliminate
	3 Use drop ball to eliminate secondary blasting
	4 Consider expected atmospheric conditions before
charging	and blasting
Blasting Vibrations	1 Restrict maximum instantaneous detonated
	2 Optimize blast-hole geometry
	3 Alter time and frequency of blasting
	4 Consider ripping in softer formations
Mobile Equipment Noise	1 Select vehicle routes carefully
	2 Fit efficient silencers and enclose compartments
	3 Damp mechanical vibrations
	4 Erect bank, screen, or barrier
Fixed Plant Noise	1 Reduce noise at source by damping treatment, etc.
	2 Isolate source by enclosure in building, room, etc.
	3 Carefully select fixed plant site
	4 Erect bank, screen, or barrier close to noise source or receiver

6.8 Cultural Resources.

Use of an existing quarry site would not affect cultural resources. If an archeological site was uncovered during excavations, an immediate evaluation would be required and measures would be taken to recover the information or protect the site. The State Historic Preservation Officer would be notified immediately.

6.9 Visual Resources.

The visual intrusion of quarry excavations varies according to the location, type of excavation, and proximity to population centers. Those on hillsides and hilltops may cause severe visual intrusion; those in shallow pits or flat areas may have less of a visual impact. Often it is spoil mounds, waste disposal areas, and processing plants that cause problems. Shallow pits in flat areas, which either are worked progressively or have little overburden and spoil, do not usually intrude much visually into the landscape. At long-established quarries, remedial work is often limited to cosmetic treatment; with new developments, methods of reducing visual intrusion can be considered from the earliest planning stages.

Since spoil and waste areas can present visual intrusion problems, they require careful siting and landscaping. In many cases, solid wastes can be used to advantage in constructing screening dikes, infilling, reclaiming poor-quality land near the quarry (i.e., improving drainage and ground levels), backfilling excavations, etc. Other problems can include dust-blow contamination of runoff water and sterilization of land.

Table EA-6 summarizes the main causes of visual intrusion from quarry operations and the possible remedial measures.

6.10 Socioeconomic.

Local economies can greatly benefit from a quarry operation depending upon the location and size of the quarry. A quarry employs people from nearby settlements and contributes to the cash flow of the economy. Sometimes the quarry operation provides food and housing to its employees and therefore is less of a boon to the local economy. Quarry products are usually transported by truck or barge. In an urban area, traffic patterns, safety, and nuisance factors such as dust and noise are considerations.

6.11 Wilderness.

Stone quarries are often in upland areas important for their scenic or scientific value and may create land-use conflicts. A long-term land-use commitment to quarry development is assumed to have been made in view of the possible wilderness values in an area. Once the quarry has been depleted, reclamation to return the land to natural processes is possible.

Table EA-6.--Main causes of visual intrusion of quarry workings, and possible remedial measures

SOURCE OF VISUAL INTRUSION	REMEDIAL MEASURES
Quarry Faces and floor working	1 Selection of site 2 Choice of direction, method, and rate of 3 Screening by banks, trees, etc.
Waste Disposal Areas infilling, old	1 Choice of dump site 2 Use of waste for amenity purposes (banks, quarries, etc.) 3 Landscaping 4 Method of deposition (e.g., perimeter mounding) 5 Screening
Stockpiles	1 Selection of location 2 Enclosure 3 Screening
Mobile Equipment	1 Choice of haul routes 2 Screening 3 Camouflage undesirable for safety reasons
Fixed Plant and Buildings	1 Site selection 2 Enclosure and use of unobtrusive colors 3 Low profile 4 Screening
Road and Rail Access Points	1 Site selection 2 Screening 3 Landscaping
Dust Plumes	1 Suppression 2 Collection

7. COMPLIANCE WITH ENVIRONMENTAL REGULATIONS

Table EA-7 shows the project's compliance status with environmental laws and statutes.

Table EA-7. -- Status of project with applicable laws and statutes

Federal Statute	Compliance/Status
Archaeological and Historic Preservation Act	Full
Clean Air Act of 1977, as amended	Full
Clean Water Act of 1977, as amended	Full
Coastal Zone Management Act	Full
Endangered Species Act of 1973, as amended	Full
Estuary Protection Act	Full
Federal Water Project Recreation Act, as amended	Full
Fish and Wildlife Coordination Act	Full
Land and Water Conservation Fund Act, as amended	Full
Marine Protection, Research and Sanctuaries Act, as amended	N/A
National Environmental Policy Act of 1969, as amended	Full
National Historic Preservation Act of 1966, as amended	Full
Rivers and Harbors Act	Full
Watershed Protection and Flood Prevention Act, as amended	N/A
Wild and Scenic Rivers Act, as amended	N/A
Executive Orders, Memorandums, Etc.	
Floodplain Management (E.O. 11988)	Full
Protection of Wetlands (E.O. 11990)	Full
Environmental Effects Abroad of Major Federal Actions (E.O. 12114)	N/A
Analysis of Impacts on Prime and Unique Farmlands (CEQ Memo Aug. 11, 1980)	N/A
Protection and Enhancement of Environmental Quality (E.O. 11514 and 11991)	Full
Protection and Enhancement of the Cultural Environment (E.O. 11593)	Full

All applicable laws and regulations listed would be fully complied with upon completion of the environmental review, issuance State water quality certification, and concurrence with our determination on cultural resources and coastal consistency.

8. CONCLUSION

It does not appear that construction of the proposed harbor improvements at St. Paul Island would have adverse environmental effects at Village Cove, Salt Lagoon, or to the immediate area. Construction of the offshore reefs would cover 9 acres of fairly unproductive sandy bottom habitat. This habitat would be replaced with a more locally scarce rocky habitat having 20 percent more than the present surface area for colonization by marine organisms. This trade of habitat types does not appear to be either a loss or gain.

The dredging of the entrance channel and maneuvering basin changes the habitat only in terms of depth. Benthic species inhabiting the existing substrate should recolonize the substrate after the project, although the greater depth may change the species composition.

The construction of the spending beach could create some intertidal and shallow subtidal habitat that may be beneficial. The proposed spending beach design should discourage use by fur seals and limit the potential for fur seal-human conflict. The spending beach design would allow the suspended sediment to settle before entering the harbor complex. This may prove to be beneficial for maintenance dredging since the material would be free from pollutants that may occur in the harbor. The side slopes and the intertidal nature of the spending beach would not lend itself to development and the associated potential impacts to Salt Lagoon and boulder spit. Although this would not preclude development, further public review would be required.

The most inherent impact associated with the proposed action is the potential for the introduction of rats to the island. Rats could devastate the seabird population of the island. The foreign freighters have a higher probability of containing rats just because of their size. The diversity of their cargo and the lack of uniform standards for their inspections and maintenance also lead to concerns about rat infestation.

Freighters would be entering the harbor three to four times per year. It takes approximately 24 hours to load and unload these vessels. Since there are few vessels and a relatively short amount of time for the vessels to be in the harbor, a very active approach could be employed to ensure rats are either not on the vessels or that they cannot get ashore. The city of St. Paul has stated they are willing to have such a program. The city of St. Paul, with guidance from the USFWS, has agreed to establish a program and ensure that the program is implemented for every freighter that enters the harbor.

The wave energy channel to Salt Lagoon will be modeled during the preconstruction engineering and design phase of the project. Alaska District hydraulic engineers and biologists, with assistance from representatives from NMFS and USFWS, will jointly work on the model to design a wave energy channel that offers the maximum water exchange with Salt Lagoon, while minimizing loss of least auklet habitat without affecting water velocities in the harbor. The final design will be adopted only when it is fully accepted by all the participants. The wave energy channel would be the first construction action of the project. While the remainder of the harbor improvements are being constructed, circulation in Salt Lagoon and nesting behavior of the least auklets on the altered boulder spit would be monitored. This would allow for changes in the design before the project is completed.

The proposed harbor improvements project has been designed to minimize environmental damage from both direct and indirect (secondary) effects. The proposed action does not constitute a major Federal action significantly affecting the quality of the human environment, and an Environmental Impact Statement is not required for harbor improvements at St. Paul Island, St. Paul, Alaska.

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ENVIRONMENTAL ASSESSMENT
APPENDIX 1

ST. PAUL HARBOR IMPROVEMENTS
ST. PAUL ISLAND, ALASKA
EVALUATION UNDER SECTION 404(b) (1)
CLEAN WATER ACT

I. Project Description

A. General Description.

The proposed project consists of four actions:

1. Construction of three parallel offshore reefs in front of the main breakwater. The reefs will require approximately 117,000 cubic yards (yd^3) of rock (75,000 yd^3 of armor stone and 42,000 yd^3 of bedding stone) to cover about 9 acres of subtidal substrate.

2. Dredging approximately 130,000 yd^3 of material to reach -32 feet MLLW for the 14-acre entrance channel. The maneuvering basin would be at -29 feet MLLW and would require the dredging of 220,000 yd^3 of material from an area of about 10 acres.

3. Construction of a spending beach behind the detached breakwater to reduce wave heights within the harbor. The spending beach will require 60,000 yd^3 of dredged material and 18,000 yd^3 of rock to bring the fill to +4 feet MLLW around the perimeter and 0 feet MLLW in the middle. The intertidal fill will be about 3 acres.

4. Construction of a wave energy channel into Salt Lagoon. The 100-foot-wide channel would be constructed with a channel invert at +2 feet MLLW.

Refer to Section 2 of the Environmental Assessment and Section 5 of the Feasibility Report for general descriptions and figures of the project features. For a more technical description of the project elements, refer to the Hydraulics Appendix A.

II. Factual Determinations

A. Physical Substrate Determinations

The nearshore sand, gravel, and rock substrate at the all the sites are similar, except at the wave energy channel location, and ranges from cobble to rock 2 feet in diameter. The larger rocks are round and difficult to dredge. The wave energy channel site is the natural boulder spit, consisting of round rocks from 2 to 3 feet in diameter. There is little fine-grained material (silts and clays) in the Village Cove area.

B. Water Circulation, Fluctuations, and Salinity Determinations

A three-dimensional model of the harbor complex was constructed at the Waterway Experiment Station in Vicksburg, Mississippi. The model was used, in part, to simulate circulation patterns within the harbor. The model demonstrated an increase in wave heights with the proposed dredging of the entrance channel and maneuvering basin. The purpose of the spending beach is to lessen wave heights within Village Cove, ensure proper water circulation within the harbor for the dispersal of pollutants, and the distribution of suspended sands entering the harbor during storms. The tidal- and storm-induced flushing of the harbor is excellent, with no "dead zones." Water circulation is the strongest in the area of the detached breakwater and weakest at the northwest corner. Suspended material would mainly fall out in the indent of the spending beach, with some material depositing toward the center of Village Cove. The estimated sedimentation rate is 2,000 yd^3 per year. Construction of the breakwaters decreased tidal circulation by 4 percent. The proposed harbor improvements would not affect tidal circulation. Studies have indicated Salt Lagoon has become less saline since the construction of the breakwaters. The proposed energy channel would increase storm-generated water circulation in Salt Lagoon and would stabilize salinity levels.

C. Suspended Particulate/Turbidity Determinations

An increase in suspended sediment load and turbidity is expected during and immediately following construction activities. The amount of fines in the material to be dredged is extremely low, and there are no fines in the rock material for the construction of the offshore reefs. Concentrations are not expected to approach lethal dosage (above 0.5 grams per liter) over the initial mixing period for aquatic species known to occur in the area. Short-term reduction of plankton populations is anticipated due to increased turbidity. No long-term water column effects are anticipated.

D. Contaminant Determinations

The proposed construction project would not be associated with any contaminant materials and would not contribute to degradation of water quality in Village Cove. Marine sediments mainly enter the harbor through the gap between the detached breakwater and boulder spit. The fish processors discharge their wastes at East Landing, far removed from Village Cove. The water in Village Cove is of such high quality that all three processors take their processing water from within the cove. The Pribilof Islands have no other industry. There is no reason to believe that the material to be dredged contains any contaminants.

E. Aquatic Ecosystems and Organism Determinations

During construction, fill would be placed to create the offshore reefs and spending beach. This would destroy about 12 acres of subtidal habitat. This would eliminate productive sediments used by sessile burrowing aquatic invertebrates. A reduction in primary and secondary productivity and species diversity is expected. However, the offshore reefs would provide 5 times the surface area than the existing condition. Rocky subtidal habitat is rare in the central Bering Sea. The proposed rock fill should attract species suitable to this type of environment.

Dredging the entrance channel and maneuvering basin would affect about 24 acres of subtidal substrate composed of sands, gravel and rocks. All non-mobile organisms in this area would be lost. The substrate is similar throughout its vertical profile; the post-dredged substrate would be of the same composition as the existing condition. The major difference would be the change in depth. The dredged area should recolonize quickly if the change in depth does not exceed the particular species requirements.

The spending beach would cause little change on the lower subtidal section. This portion of the spending beach would be constructed with dredged material, which has the same composition as the existing condition. The upper subtidal and intertidal area would be rock only and would be considerably different than the present condition. The species composition that would colonize the upper spending beach is not known; however; it is expected to be fairly productive because of the nutrient rich waters of Village Cove and the Bering Sea.

F. Proposed Disposal Site Determinations

The proposed action would comply with applicable water quality standards. Recreational and commercial fisheries would be positively impacted by this project. Mobile fish species might avoid the area due to increased activity both during and after construction, as vessel traffic in the area increased. No parks, national or historic monuments, national seashores, wilderness areas, or similar preserves are located in the Village Cove area. The fur seal rookeries are National Historic Landmarks, but they are far from the project site.

G. Determination of Cumulative Effects on the Aquatic Ecosystem

Increased boat traffic might occur in the Village Cove area as a result of harbor improvements. Harbor improvements would not decrease water circulation, and no cumulative effects are foreseen with the development of offshore reefs. The greater number of vessels entering the harbor would increase vessel activity and incidental release of pollutants, such as paints, fuel, grease, oils from boats, and from discarded debris. The degree of degradation would depend on harbor regulations and their enforcement to ensure the proper handling of sewage, refuse, wastes, and other pollutants.

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge. Adaptation of the Section 404 (b)(1) Guidelines to this Evaluation.

A. Adoption of the Section 404 (b) (1) Guidelines.

The proposed project complies with the requirements set forth in the Environmental Protection Agency's guidelines for specification of discharge sites for dredged or fill material.

B. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem

By their nature, harbor improvements must occur in the water or adjacent to water. The several different alternatives were evaluated to decrease overtopping of the main breakwater. Only two alternatives were able to meet the project objective. Both alternatives were offshore reefs.

All dredged material from the entrance channel and maneuvering basin would be taken to an upland site for disposal except for the 60,000 yd^3 of dredged material for the spending beach. The spending beach must be placed in the water to decrease wave heights. The spending beach was designed to leave as little a footprint as possible. The spending beach is intertidal and is designed to discourage use by fur seals.

C. Compliance with Applicable State Water Quality Standards

The proposed project is not expected to negatively affect water supplies, recreation, growth and propagation of fish, shellfish and other aquatic life, or wildlife. It is not expected to introduce petroleum hydrocarbons, radioactive materials, residues, or other pollutants into waters of Village Cove or the Bering Sea. The project would not affect water quality parameters such as pH, dissolved oxygen, temperature, color, etc. A temporary increase in turbidity would result from construction activities. The project complies with State water quality standards.

C. Compliance with Applicable Toxic Effluent Standards or Prohibition Under Section 307 of the Clean Water Act

No toxic effluents that would affect water quality are associated with the proposed project. Therefore, the project complies with toxic effluent standards of Section 307 of the Clean Water Act.

D. Compliance with Endangered Species Act of 1973

The proposed project complies with the Endangered Species Act. The Corps of Engineers has coordinated with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. Both agencies are responsible for management of protected species.

E. Evaluation of Extent of Degradation of the Waters of the United States

No municipal or private water supplies are in the area that could be negatively affected by the project. Commercial interests would benefit with harbor improvements at St. Paul. There would be no significant adverse impacts to plankton, fish, shellfish, wildlife, and/or special aquatic sites from this project.

ENVIRONMENTAL ASSESSMENT
APPENDIX 2

ST. PAUL HARBOR IMPROVEMENTS
ST. PAUL ISLAND, ALASKA
DRAFT FISH AND WILDLIFE
COORDINATION ACT REPORT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services Anchorage
605 West 4th Avenue, Room 62
Anchorage, Alaska 99501

IN REPLY REFER TO:
WAES

JUL 30 1996

Colonel Peter A. Topp
District Engineer, Alaska District
U.S. Army Corps of Engineers
Post Office Box 898
Anchorage, Alaska 99501

Re: Draft Fish and Wildlife
Coordination Act Report:
St. Paul Harbor Improvements
Project

Dear Colonel Topp:

Enclosed is the U.S. Fish and Wildlife Service's draft Fish and Wildlife Coordination Act (FWCA) Report on the U.S. Army Corps of Engineers' (Corps) St. Paul Island Harbor Improvements Project, Pribilof Islands, Alaska. The document was prepared in accordance with the Fiscal Year 1996 scope of work and the FWCA (PL 85-624 Section 2(b)), and is being provided for equal consideration of fish and wildlife conservation with other project purposes.

The report also contains information on threatened and endangered species, pursuant to Section 7 of the Endangered Species Act of 1973, as amended (Act). Should additional species be listed, the Corps should re-initiate consultation procedures with the Service pursuant to Section 7 of the Act.

Findings herein are based on information provided by Corps' project biologist John Burns. Biological information are based on literature review, a field investigation, and coordination with the Corps.

If you have any questions or need additional information, please contact project biologist Laurie Fairchild at 271-2788 or me at 271-2787.

Sincerely,

A. G. Rappoport

Ann G. Rappoport
Field Supervisor

Enclosure

cc: EPA, NMFS, ADFG - Anchorage
Alaska Maritime NWR

St. Paul Island Harbor Improvements Project
Pribilof Islands, Alaska

Draft Fish and Wildlife Coordination Act Report

Prepared for:

U.S. Army Corps of Engineers
Alaska District

by:

Laurie Fairchild
Anchorage Ecological Services
Field Office
Anchorage, Alaska

July, 1996

SUMMARY

The U.S. Army Corps of Engineers proposes to construct improvements at St. Paul Harbor and provide additional tidal flushing of Salt Lagoon via excavation of a wave energy channel. The project is located on St. Paul Island, part of the Pribilof Island group in the Bering Sea.

Modeling for the harbor improvements has been completed and is planned for the wave energy channel in October, 1996. The channel to Salt Lagoon will only be excavated if modeling and resource data indicate it would not cause further degradation of water quality in the lagoon or long-term harm to the least auklet colony. Construction of the wave energy channel would be restricted during the May 15-June 30 time period. The Service recommends that existing ship wreckage be removed from Village Cove Beach in conjunction with construction of the wave energy channel to provide additional least auklet nesting habitat. Deleting the wave energy channel would not compromise other aspects of the proposal.

Deeper dredging of the entrance channel will allow large vessels into the harbor. Foreign trampers, generally recognized as having a higher risk of rat infestation, will visit the harbor three to five times per year, according to Corps of Engineers estimates. The Service also recommends that prior to entrance channel dredging, an effective rat prevention and ship inspection program be established by the City of St. Paul to address the potentially serious risk the introduction of rats poses to the abundant wildlife resources on the island.

INTRODUCTION

This report constitutes the U.S. Fish and Wildlife Service's draft Fish and Wildlife Coordination Act (FWCA) Report for the U.S. Army Corps of Engineers' St. Paul Island Harbor Improvements Project, Pribilof Islands, Alaska. The document was prepared in accordance with the Fiscal Year 1996 scope of work and the FWCA [PL 85-624 Section 2(b)], and is being provided for equal consideration of fish and wildlife conservation with other project purposes. This report builds upon a Planning Aid Letter (March 1996) prepared for the proposed project.

Service involvement in the project includes evaluating the potential impacts of the project on fish and wildlife resources and their habitats and recommending methods for mitigating adverse impacts and/or enhancing these resources, where practicable.

The Pribilof Islands are centrally located in the Bering Sea, about 750 miles west of Anchorage, Alaska (Figure 1). There are four islands in the chain; St. Paul and St. George Islands are the largest. Both St. Paul and St. George support small villages whose economies are largely based on the seafood industry.

Island habitat is treeless, consisting of lush, tall grasses, lupine, puchki, low-growing berries and numerous wildflowers. The Pribilof Islands also support a diversity of wildlife including seabirds, northern fur seals, Steller sea lions, arctic fox, shrews, and lemmings. Reindeer have been introduced on the two populated islands.

Harbors were constructed on St. Paul and St. George Islands in 1989 by the Army Corps of Engineers. They were intended to service the small fleet of local fishermen for commercial fisheries harvest activities. Rapid expansion of crab harvest activities in the Pribilofs has resulted in a huge demand for services and resulted in a dramatic increase in the size and number of vessels using St. Paul Harbor. Although size and draft of the average vessel coming into the harbor has almost doubled, the dredged depth of the entrance channel and harbor have remained approximately the same. Consequently, problems are occurring with vessel groundings and maneuverability within the harbor.

In addition, St. Paul Harbor has experienced periodic problems from waves overtopping the main breakwater, causing damage to buildings and shifting rock within the breakwater itself. A large floating processor moored in the harbor recently broke its ties during an extreme storm. Breakwater stabilization and/or construction of a wave-reduction barrier is needed to minimize future breaching of the breakwater and associated damage.

PROJECT DESCRIPTION

The Corps proposes to deepen the entrance and maneuvering channel to provide better access to the docks and harbor facilities (Figure 2). This is intended to aid vessels currently using the harbor (200 feet plus) as well as ships up to 375 feet in length (trampers currently unable to safely access the harbor). Several reefs would be built seaward of the main breakwater to reduce wave height and overtopping from heavy storms. A spending beach that will be mostly submerged has been proposed to further deflect waves within the harbor. During modeling at the Corp's Water Experiment Station in Vicksburg, Mississippi (October - December 1995), this design proved to have the added benefit of catching sediments before they reached the inner harbor, depositing them in an eddy at the indented eastern side of the fill, away from the harbor's entrance.

The Corps also proposes to mitigate decreased tidal exchange and flushing in Salt Lagoon caused by harbor construction by excavating a storm surge channel through Village Cove Beach. The proposed channel would be located outside the detached breakwater, seaward of the harbor. A jetty is proposed inside Salt Lagoon to aid water circulation.

Channel bottom elevation would be approximately +2.0 feet MLLW so that flushing in the lagoon would only occur during storm events. This design is meant to mimic hydrologic interactions between Salt Lagoon and Village Cove prior to harbor construction. The Corps plans to excavate the channel first, so monitoring can be conducted during completion of the project. Several storm events would be observed over the expected two-year construction phase of the project.

ALTERNATIVES

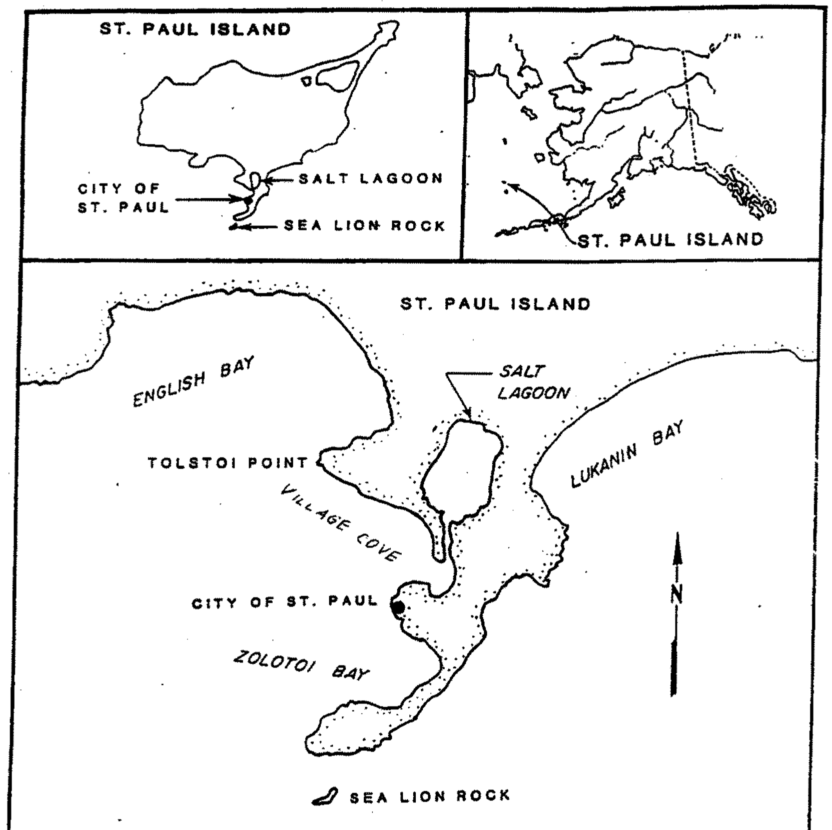
No Action

No action would be taken to improve maneuverability within the harbor.

Preferred Alternative

This alternative includes: 1) constructing three offshore reefs (117,000 cubic yards of rock over a 9-acre area) seaward and parallel to the main breakwater near the toe of the existing breakwater; 2) dredging the entrance channel to -32 feet MLLW and the maneuvering channel within the harbor to -29 feet MLLW; 3) constructing a mostly submerged "spending beach," (estimated at less than 3 acres) on the harbor side of the detached breakwater, with slopes and contours designed to reduce wave action within the harbor; and 4) enhancing water circulation within Salt Lagoon via a wave energy channel cut into Village Cove Beach. The wave energy channel would be approximately 100 feet wide at a bottom elevation of +2.0 feet MLLW, wider at the channel mouth, and designed to slow breaking waves before entering the lagoon. Boulders would line the surge channel in a size and number sufficient to recreate least auklet habitat lost to excavation of the channel. The channel would be constructed in the winter, and equipment would access the site across the frozen lagoon.

This plan would include dredging approximately 415,000 cubic yards of sand, gravel, and fractured rock from approximately 24 acres. An estimated 70,000 cubic yards of the dredged material will be used to construct the spending beach. No blasting would be required and excess material would be disposed of at an upland site.



LOCATION AND VICINITY MAP		
FIGURE 1	SAINT PAUL ISLAND HARBOR	FIGURE 1

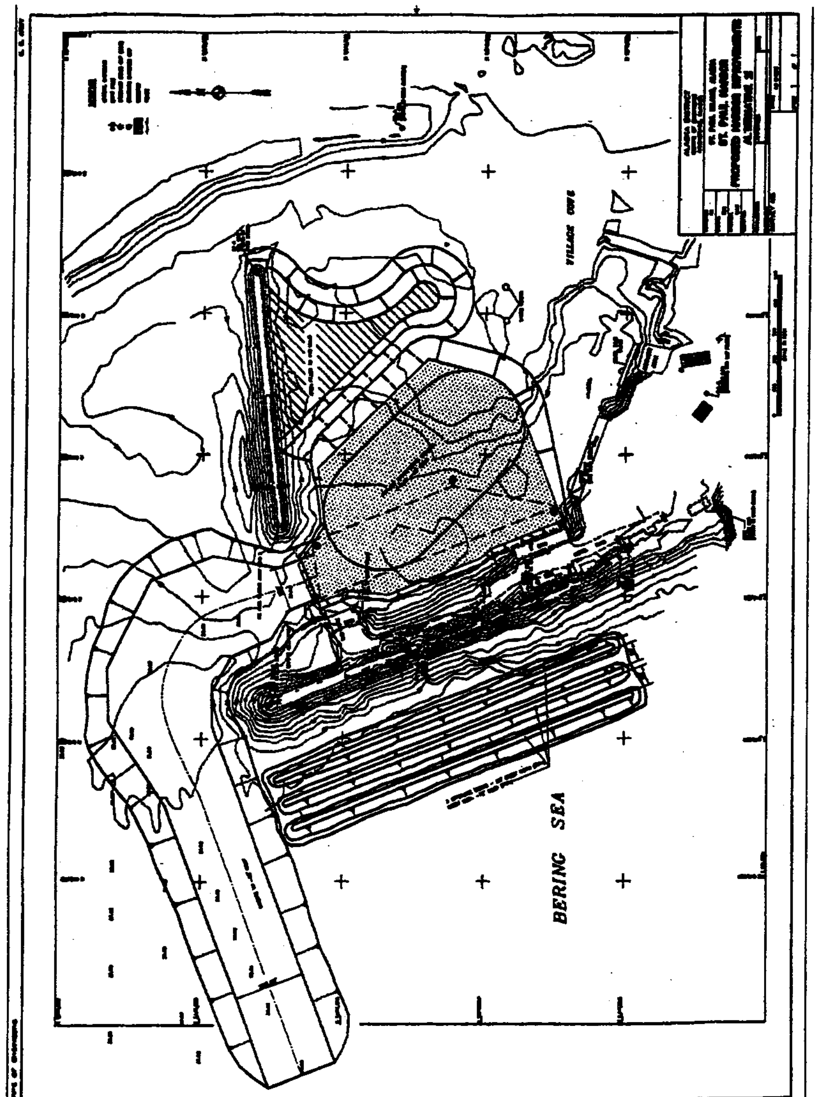


FIGURE 2

Other Alternatives

Three other versions of the preferred alternative were discussed in earlier Corps reports, and are detailed in Section 3 of the Harbor Improvements and Draft Interim Feasibility Report and Environmental Assessment (EA). The design and/or presence of the spending beach was the biggest variance between these alternatives.

RESOURCES

Fish and Wildlife

Eleven species of seabirds (see Appendix A) return to the Pribilof Islands annually to nest and rear young. An estimated 250,000 seabirds are found at cliffs and burrows on St. Paul Island. A least auklet colony of several thousand birds extends the length of Village Cove Beach.

More than 80% of the world's red-legged kittiwake population nest on Pribilof Island cliffs. The species is of concern to the Service because numbers on index plots in the Pribilof Islands declined by about 50% between the mid-1970s and the early 1990s. A status report recently completed on the red-legged kittiwake (Byrd 1994) suggests declines in the Pribilof Island population may have slowed or stopped in recent years. The report recommended continued concern for the species until another count can be made. A population count for this and other seabird species in the Pribilof Islands is scheduled for 1996 by the Alaska Maritime National Wildlife Refuge.

Salt Lagoon, the only salt estuary in the Bering Sea, is an important resource for migrating sandpipers and turnstones as well as migratory Eurasian species. Many sea ducks, including king and Stellar's eiders, winter near the Pribilof Islands. Several small ponds near Salt Lagoon occasionally harbor small numbers of waterfowl, including northern pintail, mallards, and green-winged teal.

The Pribilof Island shrew is endemic to St. Paul Island. It is of concern to the Service because it occurs only on St Paul. It appears to be distributed widely at relatively high densities within vegetative communities dominated by tall plants, particularly beach rye, bluegrass, wild celery, and sage (Byrd and Norvell).

Artemisia Globularia lutea is a rare plant found on St. Paul Island. However, it is not known to occur within the immediate project area and would not likely be affected by project construction.

Marine mammals are frequently seen inside the harbor. Harbor seals are relatively common. Seventy-five percent of the world's population of northern fur seals establish harems and pup on established rookeries scattered around the islands. Several of these are located near St. Paul Harbor. Sub-adult male fur seals and pups have been seen with increasing frequency inside the harbor and occasionally at the entrance channel to Salt Lagoon.

Crab, Pacific sandfish, Pacific cod, sturgeon poacher, warty sculpin, and white-spotted greenling populate the waters of Village Cove and Salt Lagoon. Benthic organisms such as bivalves, polycheates, and assorted invertebrates are also found in and around St. Paul Harbor (Natural Resource Consultants, 1989-1991; Flint and Rybnikov, 1994). Hair crab in Salt Lagoon are sometimes taken for subsistence by villagers.

Threatened and Endangered Species

Steller's eiders have been documented in waters surrounding the Pribilof Islands during winter months. This species is currently proposed for listing as Threatened under the Endangered Species Act of 1973, as amended. In addition, Steller sea lions, a threatened species for which National Marine Fisheries Service has management responsibilities, haul out on rocky beaches of the Pribilofs.

Salt Lagoon

Salt Lagoon is located at the northeast corner of St. Paul Harbor. It is an oblong body of salt water roughly 300 acres in size, regularly flooded by tidal waters. Its only entrance connects to the head of the harbor, and it is strongly influenced by water circulation patterns in the harbor. Extension of the main breakwater and construction of the detached breakwater have significantly reduced wave action within the harbor and tidal exchange with Salt Lagoon. Increased and on-going harbor construction and maintenance activities have added to sedimentation of the original entrance channel. The lagoon entrance has been intentionally moved several times during harbor construction and subsequent development.

Monitoring has occurred since initial harbor construction to determine environmental impacts from construction on Salt Lagoon. These studies, conducted from 1988-91, found the lagoon water quality and biodiversity indicative of a healthy, dynamic system. The latest study (Flint and Rybnikov, 1994) found, given present configuration and depth of the lagoon entrance, that flushing activity from daily tides is not sufficient to maintain historic functions. The lagoon appears to be slowly "suffocating" due to insufficient tidal exchange, possibly converting to a freshwater system. Conversion of the aquatic system to one that is not biologically productive would result in a significant, if not total loss of traditional wildlife and subsistence use of the lagoon. Therefore, immediate action is required to re-establish the lagoon entrance to a depth and width that will prevent further degradation of the natural system or provide an alternate source of adequate flushing (e.g., a separate surge channel established outside the harbor).

Mud flats exposed during low tides are used by migrating sandpipers and turnstones, and occasional Eurasian species. A flock of approximately 300 red- and black-legged kittiwakes was observed roosting on the mudflats during a Service site visit in September 1995. Also observed during the site visit were a hudsonian godwit and a Sabine's gull, uncommon and casual visitors, respectively, to the Pribilofs. Harlequin ducks are present year-round and frequent the lagoon entrance channel in large numbers (June 1996 Trip Report, L. Fairchild).

Residents harvest several species of crab, fish, and invertebrates from Salt Lagoon for subsistence use. Arctic fox are frequently seen scavenging crab and other food along the mudflats.

Village Cove Beach

Village Cove Beach consists of boulder and cobble along it's entire length and receives high energy waves on a regular basis. Several pieces of rusted shipwreck are scattered the length of the beach. According to a survey conducted in 1988 (Jones 1988), this beach was the largest discrete area of least auklet nesting habitat on St. Paul Island and the site of a colony of several thousand birds. In 1988, the colony extended from Tolstoi Beach to the end of Village Cove Beach and consisted of crested and least auklets (Figure 3). Crested auklets are rare on Village Cove Beach today. An estimated 51.5% of the auklets on Village Cove Beach used the beach enclosed by the detached breakwater and harbor in 1988. No studies have been conducted for the entire colony since 1988 but data gathered during June 5-10, 1996, (June 1996 Trip Report, L. Fairchild) confirmed the linear extent of the colony remains approximately the same. Another least auklet colony of unknown size has recently been established near Antone Lake.

ENVIRONMENTAL IMPACTS

No Action

If no action is taken to improve maneuverability within the harbor, ships will continue to become caught in shallow water and the likelihood of petroleum spills and associated hazards will remain high. Should spills occur, large numbers of marine birds and mammals could be killed and others may suffer sublethal effects of petroleum contamination and ingestion. Waves will continue to overtop the main breakwater and have the potential to damage harbor facilities and affect sedimentation of Salt Lagoon. Leaving the detached breakwater as is (i.e., no additional development) will not significantly affect the safety of harbor operations. Salt Lagoon's biological viability and diversity will continue to decline if no action is taken to restore tidal flushing.

Preferred Alternative

Harbor dredging and construction of the wave reduction reefs would result in minimal environmental impacts. Temporary degradation of water quality is likely to occur with in-water work but should not have significant impact on fish and wildlife resources. Because these measures should enhance safety of boating operations within the harbor, the potential for shipwreck and associated oil spills should decrease. The reef barriers along the main breakwater would provide new fish and invertebrate habitat thus mitigating such habitat displaced by the fill.

The spending beach would also temporarily degrade water quality, and cover approximately 3 acres of benthic habitat. This area will not recolonize to pre-project conditions, but side slopes of the fill should provide habitat for other benthic organisms. Since the spending beach will be at least partially submerged during all tides, northern fur seals should not be unduly attracted to the fill as a resting area. However, any change in the configuration or use of the spending beach (i.e., additional fill for storage and/or a dock) could cause serious impacts to the Village Cove Beach least auklet colony, increase congestion in the harbor (increasing safety hazards), and provide an attraction for fur seals.

Seabird, shorebird, and waterfowl species which may be impacted by the proposed wave energy channel are those using Village Cove Beach and Salt Lagoon. Because the wave energy channel would be designed to transport water only during storm events, predicted to occur 3-4 times per year and typically during winter months, water level may not be a significant problem. However, red- and black-legged kittiwakes using the mudflats inside Salt Lagoon could occasionally be displaced due to increased water levels within the lagoon. These birds may relocate to sandy beaches to the east. However, these do not afford the protected roosting areas found in Salt Lagoon. Increased water levels would also make tidally exposed mudflats unavailable to foraging rock sandpipers and ruddy turnstones. Harlequin ducks and other waterfowl using the lagoon entrance would not be significantly impacted as long as flows were maintained at present levels (minimum). Least auklets would be displaced by the elimination of more than 100 feet of beach front, of moderate nesting density.

Potential beneficial environmental impacts of the wave energy channel include: 1) increased flushing of the lagoon, promoting biological health of the system and at least partially restoring it to pre-harbor conditions; 2) a subsequent increase in subsistence opportunities for villagers as fish, crab and other benthic organisms increase in population; and 3) boulders and cobble placed on the side slopes may replace a portion of the lost habitat, and could increase the amount of available nesting habitat overall.

The Natural Resource Consultants' monitoring studies (1991) recommended that tidal flushing in Salt Lagoon remain at or above 20 percent of its volume. This was believed to be the level at which the lagoon's unique ecosystem could continue to support fish and wildlife resources. Flint and Rybnikov (1994) did not quantify tidal flushing in 1994 but estimated it at less than 20 percent. Any future dredging or reconfiguration of Salt Lagoon's entrance should seek to reduce sedimentation of the entrance to enhance tidal exchange.

Rat Introduction

As larger vessels, with increased risk of rat infestation, are allowed access to St. Paul Harbor, the potential for rat introduction increases dramatically. The threat of rat introduction to cliff and burrow nesting seabird habitat could potentially be more devastating and persistent to island seabird populations than any large oil spill. Rats are very difficult to eradicate, requiring expensive, intense, multi-year efforts to successfully accomplish. Given the size of the island and the abundance of food and shelter on St. Paul, it is likely that rats would never be completely eradicated once established.

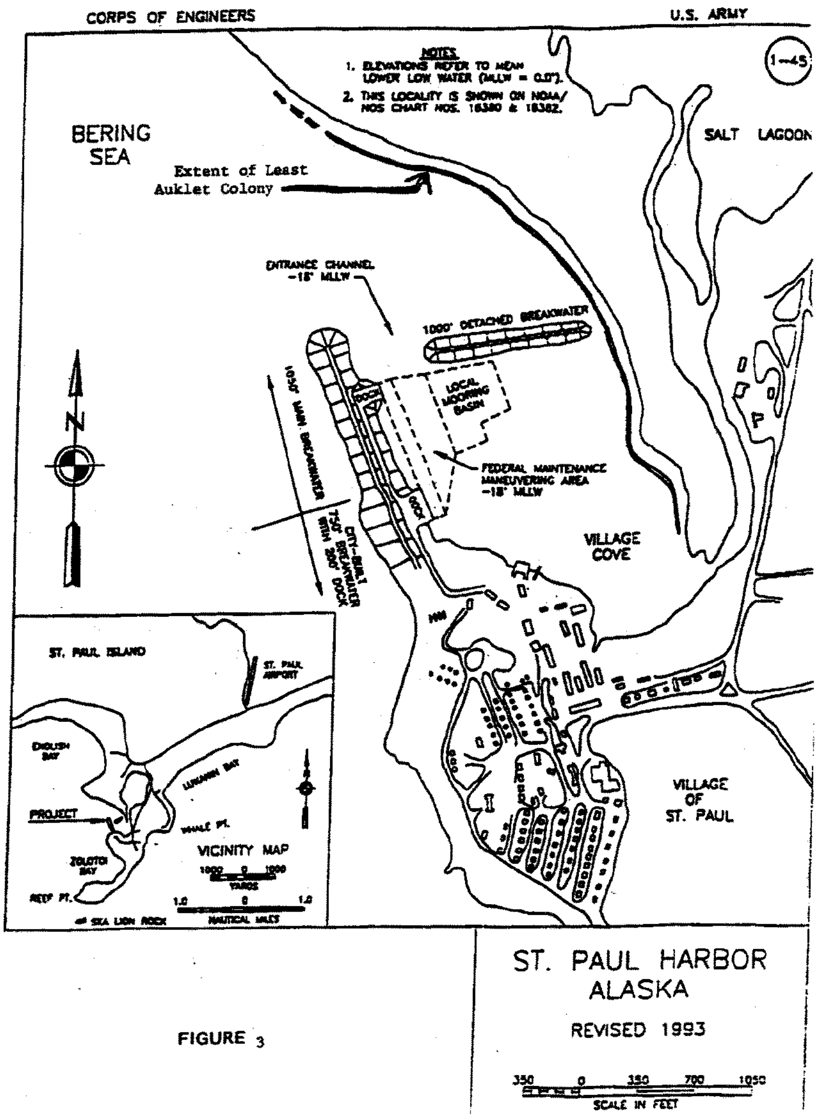

CORPS OF ENGINEERS
U.S. ARMY
NOTES
1. ELEVATIONS REFER TO MEAN LOWER LOW WATER (MLLW = 0.0').
2. THIS LOCALITY IS SHOWN ON NOAA/NOS CHART NOS. 16380 & 16382.
BERING SEA
Extent of Least Auklet Colony
SALT LAGOON
ENTRANCE CHANNEL -18' MLLW
1000' DETACHED BREAKWATER
LOCAL MOORING BASIN
1050' MAIN BREAKWATER
DOCK
FEDERAL MAINTENANCE MANEUVERING AREA -18' MLLW
CITY-BUILT 750' BREAKWATER WITH 300' DOCK
N
VILLAGE COVE
VILLAGE OF ST. PAUL
ST. PAUL ISLAND
VICINITY MAP
PROJECT
ST. PAUL HARBOR ALASKA
REVISED 1993
350 0 350 700 1050
SCALE IN FEET

FIGURE 3

In late June of 1996, the first rat was captured in a snap trap within the harbor (positioned previously as part of the Rat Prevention Program run by the City of St. Paul and the U.S. Fish and Wildlife Service). It is unknown how long the rat had been on land, but is suspected to have come from a vessel docked within a few days previous to its capture. The Corp's Environmental Assessment (1996) identifies a portion of the larger vessels coming into the harbor with the deeper channel as foreign trampers, and recognizes their serious potential for rat introduction to the island. As evidenced by the recent find on St. Paul, it takes only one ship and one visit to the harbor for rats to find their way on shore. Even though foreign vessels may only visit the harbor 3-5 times per year, each visit poses a serious threat to the 250,000 seabirds and abundant fur seals nesting and pupping on the island.

Least Auklet Colony

The least auklet colony could be seriously adversely impacted if fill placed behind the detached breakwater is used for any purpose other than wave reduction. It is not a suitable site for storage or boat activities that would greatly enhance human disturbance of the Village Cove Beach auklet colony. Least auklets roosting on beach boulders, entering or leaving a nest site, are easily disturbed when approached and are often seen flying in mass over a colony before settling down again. Every forced flight due to disturbance from humans and predators costs the bird energy it needs for nesting, egg-laying, chick-rearing and foraging in often harsh weather. This increased energy demand on adult birds could result in increased adult mortality as well as decreased egg-hatching and chick-fledging success. Birds are likely to abandon nest sites, forcing them to find other habitat, if available.

DISCUSSION

It is clear from the history of St. Paul Harbor, that the demand generated by a local and commercial fishery for marine services and access was not predicted by previous planning efforts. The need for the proposed harbor modifications is in direct response to larger vessels already squeezing into the harbor and the economic benefits realized from loading product directly to the trampers from shore.

The EA states "construction of the main and detached breakwaters in 1989 decreased the amount of water entering Salt Lagoon during severe storms." Harbor construction and development activities have significantly contributed to modifications in the lagoon's entrance channel. It is clear the Corps recognizes the secondary impacts to Salt Lagoon from the harbor and are exploring methods to correct them. Dredging the wave energy channel may present an opportunity to improve the flushing at Salt Lagoon's entrance, ensuring better long-term health of the system. However, alternatives to a channel (e.g., a culvert or maintenance dredging of existing lagoon entrance) and alternate channel locations should be fully explored before a final decision is made. Modeling will aid the resource in final risk analysis.

Dredging the harbor to allow access by foreign trampers could also have major secondary impacts. An aggressive preventative program is needed to thwart the threat of rat introduction to the island.

The spending beach, as currently designed, does not appear to have significant environmental impacts. However, the Service would not recommend or support any alternative that proposes fill behind the detached breakwater, at present or in the future, that would be used for commercial purposes. Such uses could cause disturbance to the auklets nesting at nearby Village Cove Beach and possibly colony abandonment.

RECOMMENDATIONS

In light of the potential adverse impacts described in this report, the following recommendations must be incorporated to protect fish and wildlife resources before the proposed project goes forward:

1. An effective rat prevention program must be established by the City of St. Paul before further risks are introduced. This program should include, at a minimum, a person on site dedicated to rat prevention; equipment and personnel available to inspect suspect vessels and enforce the City's rat ordinance; and rat inspection, prevention, control training for boat operators and seafood processor personnel. The U.S. Fish and Wildlife Service has initiated such a program with the City and will continue to provide support, but does not have the staff or funding to adequately manage such a program year-round. It is imperative that enforcement and inspection capabilities be adequate if the Pribilof Islands are to remain rat free.

2. A hydrology modeling study should be completed to assess impacts to Salt Lagoon from the proposed wave energy channel. The study should include an evaluation of channel locations and configuration as well as alternatives such as culverting, to enhance tidal exchange. If a wave energy channel or other water circulation method is determined by resource agencies to be environmentally beneficial, multi-year monitoring of the least auklet colony and biological components of Salt Lagoon should be required to assess the project's success and/or need for modification.

3. In conjunction with excavation of the wave energy channel, if built, the Corps should remove wreckage (rusted pieces of an earlier shipwreck) on Village Cove Beach, to make available additional least auklet habitat.

4. Timing restrictions on the excavation of Village Cove Beach and construction of the spending beach are necessary to minimize disturbance to nesting least auklets. No construction activities should take place between May 15 and June 30, for these components of the project.

The above recommended measures are necessary to mitigate environmental impacts and assess potential risks/benefits of a storm surge channel to Salt Lagoon. The Service will continue to participate in data gathering and provide technical assistance regarding Salt Lagoon and the least auklet colony.

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Appendix A

SPECIES LIST

Birds, Mammals, and Plants of St. Paul Island, Alaska.

BIRDS:

Common Name	Scientific Name
Northern fulmar*	*Fulmarus glacialus*
Short-tailed shearwater	*Puffinus tenuirostris*
Red-faced cormorant*	*Phalacrocorax urile*
Green-winged teal	*Anas creca*
Northern pintail	*Anas acuta*
Northern shoveler	*Anas clypeata*
Greater scaup	*Aythya marila*
Steller's eider	*Polysticta stelleri*
Harlequin duck	*Histrionicus histrionicus*
Oldsquaw	*Clangula hyemalis*
Common goldeneye	*Bucephala clangula*
Bufflehead	*Bucephala albeola*
Sandhill crane	*Grus canadensis*
Lesser golden plover	*Pluvialis dominica*
Semipalmated plover	*Charadrius semipalmatus*
Wandering tattler	*Heteroscelus incanus*
Bar-tailed godwit	*Limosa lapponica*
Ruddy turnstone	*Arenaria interpres*
Pectoral sandpiper	*Calidris melanotos*
Sharp-tailed sandpiper	*Calidris acuminata*
Rock sandpiper	*Calidris ptilocnemis*
Red-necked phalarope	*Phalaropus lobatus*
Pomarine Jaeger	*Sterocorarius pomarinus*
Parasitic Jaeger	*Sterocorarius parasiticus*
Long-tailed Jaeger	*Stercorarius longicaudus*
Glaucous-winged gull	*Larus glaucescens*
Black-legged kittiwake*	*Rissa tridactyla*
Red-legged kittiwake*	*Rissa brevirostris*
Commone murre*	*Ursa aalge*
Thick-billed murre*	*Ursa lomvia*
Pigeon guillemot	*Cepphus columba*
Parakeet Auklet*	*Cyclorrhynchus psittacula*
Least auklet*	*Aethia pusilla*
Crested Auklet*	*Aethia cristatella*
Tufted puffin*	*Fratercula cirrhata*

BIRDS:

Common Name	Scientific Name
Horned puffin*	*Fratercula corniculata*
Winter wren	*Troglodytes troglodytes*
Lapland longspur	*Calcarius lapponicus*
Snow bunting	*Plectrophenax nivalis*
Rosy Finch	*Leucosticte arctoa*

MAMMALS:

Common Name	Scientific Name
Arctic fox	*Alopex lagopus*
Reindeer	*Rangifer tarandus*
Pribilof Island shrew	*Sorex pribilofensis*
Harbor seal	*Phoca vitulina*
Northern fur seal	*Callorhinus ursinus*
Steller sea lion	*Eumetopias jubatus*

PLANTS:

Common Name	Scientific Name
Beach rye	*Elymus arenarius*
Bluegrass	*Poa eminens*
Sage	*Artemesia arctica*
Wild celery	*Angelica lucida*

* Indicates 11 principal seabird species.

ENVIRONMENTAL ASSESSMENT
APPENDIX 3

ST. PAUL HARBOR IMPROVEMENTS
ST. PAUL ISLAND, ALASKA
HARBOR CIRCULATION STUDY

DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
P.O. BOX 631
VICKSBURG, MISSISSIPPI 39180-0631

REPLY TO
ATTENTION OF

CEWES-CR-O

19 January 1988

MEMORANDUM FOR RECORD

SUBJECT: Harbor Circulation Study for St. Paul, Alaska

1. The purpose of this study was to assess the influence of a proposed harbor plan for St. Paul, Alaska, on the exchange of water between the saltwater lagoon and the harbor. The exchange of water between the harbor and open water was also of interest for the proposed harbor configuration. The study was funded by the U.S. Army Engineer District, Alaska, (NPA).

2. The study was conducted with a finite element numerical model. Vertically integrated flow circulation and water surface elevations are computed in the model in response to either a forced water level fluctuation on the seaward boundary (tide) or a wind field imposed over the entire water surface. The model used was developed by Lynch and Gray (1980). This model is similar to the model originally proposed for the study (Chen 1978, Chen 1981). The Chen model was not used because difficulties were encountered in activating it on the Cybernet computer system which could not be solved within the short time frame of the study.

3. The principal part of the study was to investigate harbor response to a tidal forcing function. Two harbor configurations were modeled as follows:

a. Existing, including the existing stub breakwater (Figure 1).

b. Proposed, with extension of the breakwater stub and addition of a detached breakwater (Figure 2).

The grid is shown in Figure 3. Shaded triangular elements can be treated as land or water, depending on which harbor configuration is being tested. Bathymetry for the existing condition was used in all tests. The tidal forcing function was taken as a sinusoidal, semi-diurnal tide with a range of 3.2 ft.

4. The grid was first constructed to include the saltwater lagoon and connecting channel to the harbor. However, the physical size of the connecting channel was so small that the time step required for the model was impractical. An alternative approach was adopted. The lagoon/channel system

ROUTING:
1. C/Research Div
2: ~~Asst C/CERC~~
3: C/CERC
4:
5: Sec, CR-O

was deleted from the grid and a simple analytical method for estimating velocities in the channel was identified, as discussed later. The grid actually used is shown in Figure 4.

5. The output from the model consists of computer printouts listing surface elevation and current velocity at each grid node. Detailed computer printouts for the existing and proposed breakwaters are given in encls 1 and 2. Although the time step was 3.6 sec, values are listed for only one time step out of every 250 time steps, i.e., every 15 minutes. The model was run for approximately 11 hours to completely encompass the high and low tide conditions. The element and node numbers for the grid, needed in interpreting the computer printouts, are given in Figures 5 and 6.

6. Water surface elevation at the element adjacent to the lagoon entrance channel is plotted as a function of time in Figure 7. Curves are given for both the existing and planned configurations. Differences between the two configurations are very small. The tide range is approximately 4 percent smaller in Plan 47 and the times of high and low tide are delayed by about 15 minutes. These differences are comparable to the level of accuracy of the basic model, as evidenced by the small irregularities in the curve.

7. The effect of wind was assessed by running the model with wind and no tide for a typical case in which exchange of water between the lagoon and harbor would be adversely affected if there is any significant effect. A wind speed of 20 knots from the northeast was used at the suggestion of NPA. The steady wind was superimposed over the entire finite element domain and the model was run for sufficient time to reach a reasonably stable water level at the entrance to the lagoon channel. Both the existing and proposed Plan 47 configuration were modeled. The resulting change in water level at the entrance to the lagoon was a decrease of less than half an inch. This decrease amounts to about 1 percent of the tidal range.

8. A simple method for estimating the flow velocity in a channel connecting a lagoon and a large water body is provided by O'Brien (1976). If it is assumed that the channel is frictionless and the tide level in the lagoon is in phase and of equal range with that in the ocean (a reasonable assumption given the small physical size of the lagoon system at St. Paul), then

$$V = \frac{2\pi A_b a_b}{A_c T} \cos \sigma t \qquad (1)$$

where

V = velocity in the channel (ft per sec)

A_b = surface area of the bay or lagoon (square ft)

CEWES-CR-O
SUBJECT: Harbor Circulation Study for St. Paul, Alaska

A_c = channel cross sectional area (square ft)

a_o = ocean tide amplitude, i.e., half-tidal range (ft)

T = time for one tidal cycle (sec)

$\sigma = 2\pi/T$.

If the variables A_b and T are taken as constant at St. Paul, the equation can be written as

$$V = \frac{C\,a_o}{A_c} \cos \sigma t \qquad (2)$$

where C is a constant. If the subscript "ex" is used to denote existing conditions and "plan" for Plan 47, equation 2 leads to

$$V_{plan} / V_{ex} = a_{o\,plan} A_{c\,ex} / a_{o\,ex} A_{c\,plan} \qquad (3)$$

9. The effect of Plan 47 relative to the existing condition on velocity in the channel can be estimated using equation 3 and results from the numerical model runs. Since the average cross sectional areas, $A_{c\,ex}$ and $A_{c\,plan}$, are equal to each other, equation 3 becomes

$$\frac{V_{plan}}{V_{ex}} = \frac{a_{o\,plan}}{a_{o\,ex}} \qquad (4)$$

$$= \frac{0.5\,(3.2-0.13)}{0.5\,(3.2)} = 0.96$$

Equation 4 states that the velocity ratio is equal to the tidal amplitude ratio. Thus the velocity of the tidal flow through the channel is reduced by 4 percent, which is essentially unchanged. The quantity of water moving into and out of the lagoon/channel system would decrease slightly by approximately 0.13 ft times the surface area of the system.

CEWES-CR-O

SUBJECT: Harbor Circulation Study for St. Paul, Alaska

10. In summary, the proposed harbor configuration with extension of the existing breakwater and addition of a detached breakwater is expected to have a minimal impact on the exchange of water between the saltwater lagoon and the harbor.

2 Encls

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CEWES-CR-O

SUBJECT: Harbor Circulation Study for St. Paul, Alaska

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Lynch, R., and Gray, W. G. August 1980. "An Explicit Model for Two-Dimensional Tidal Circulation Using Triangular Finite Elements, WAVETL User's Manual," Water Resources Investigations Report 80-42, U.S. Geological Survey.

O'Brien, M. P. February 1976. "Notes on Tidal Inlets on Sandy Shores," GITI Report 5, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

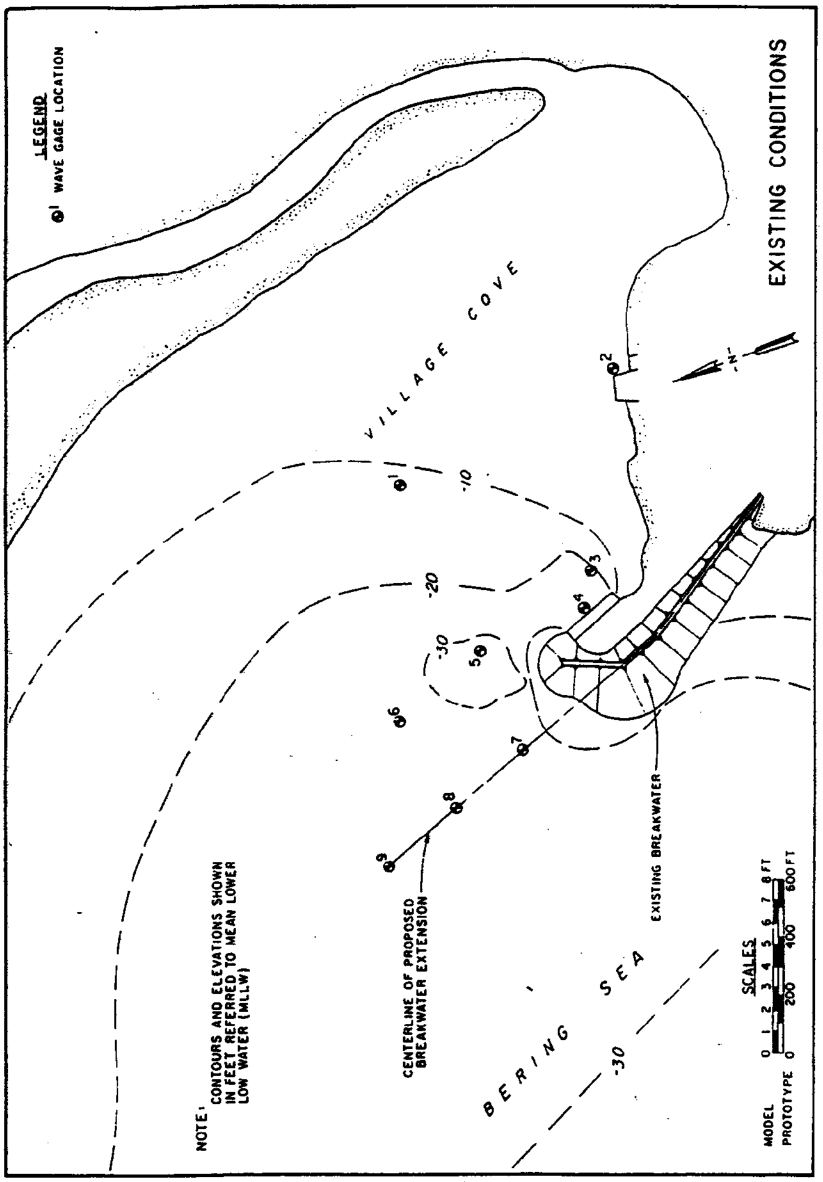

LEGEND
WAVE GAGE LOCATION
EXISTING CONDITIONS
VILLAGE COVE
BERING SEA
-10
-20
-30
-30
NOTE: CONTOURS AND ELEVATIONS SHOWN IN FEET REFERRED TO MEAN LOWER LOW WATER (MLLW)
CENTERLINE OF PROPOSED BREAKWATER EXTENSION
EXISTING BREAKWATER
SCALES
MODEL 0 1 2 3 4 5 6 7 8 FT
PROTOTYPE 0 200 400 600 FT
N

Figure 1

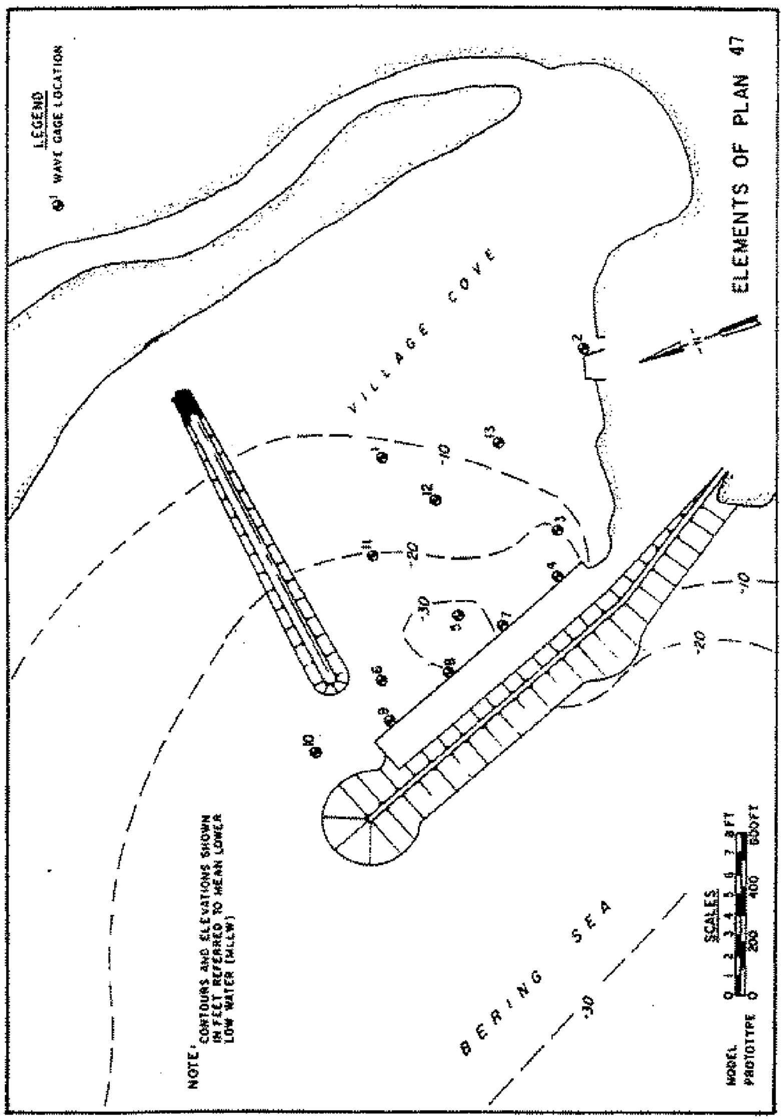
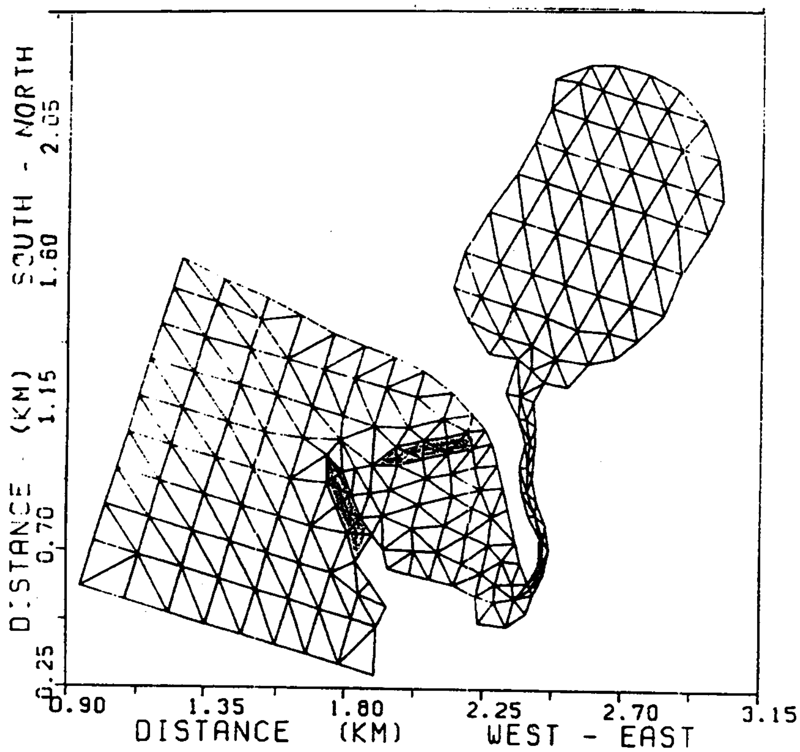
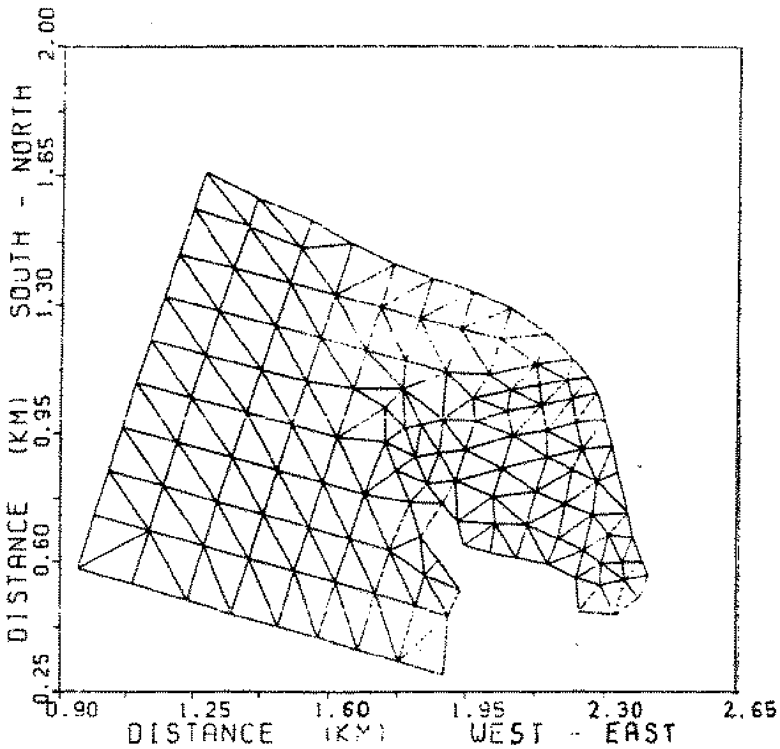

ELEMENTS OF PLAN 47
LEGEND
WAVE GAGE LOCATION
VILLAGE COVE
BERING SEA
NOTE: CONTOURS AND ELEVATIONS SHOWN IN FEET REFERRED TO MEAN LOWER LOW WATER (MLLW)
SCALES
MODEL 0 1 2 3 4 5 6 7 8 FT
PROTOTYPE 0 200 400 600 FT
-10
-20
-30

Figure 2



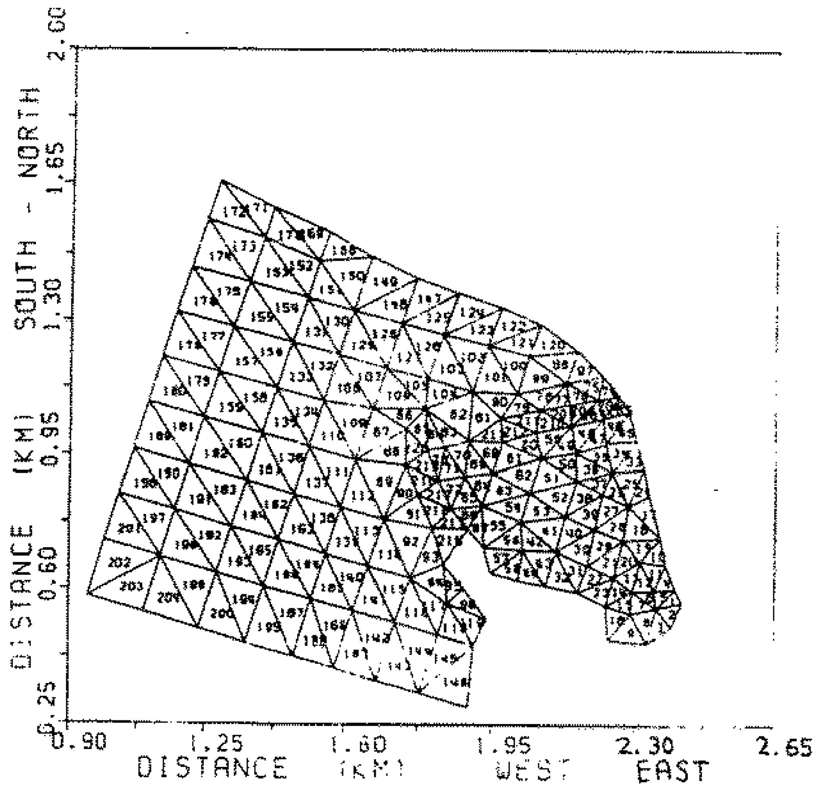
FINITE ELEMENT NETWORK OF ST. PAUL HARBOR

Figure 3



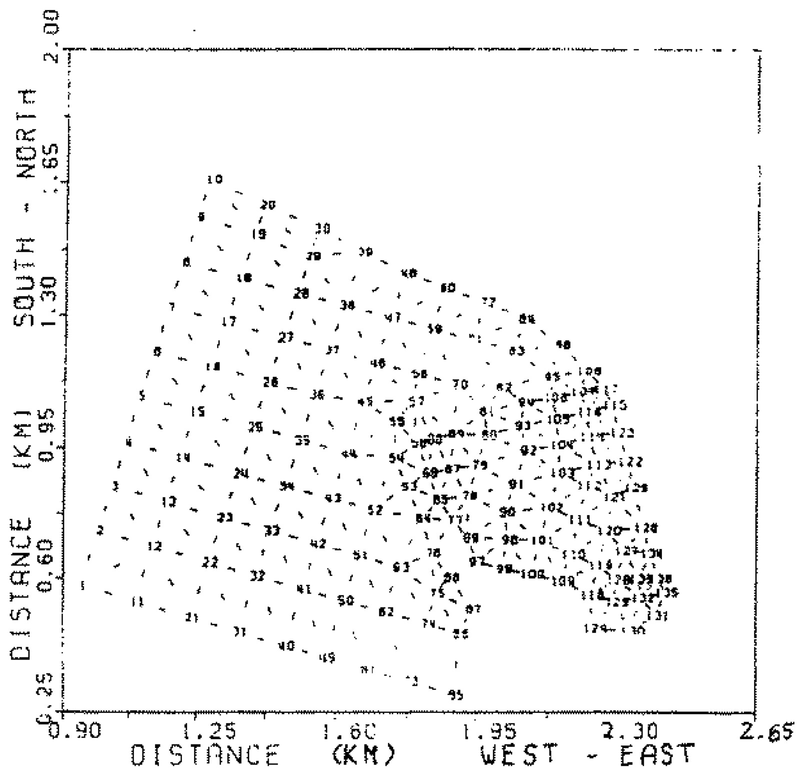
FINITE ELEMENT NETWORK OF ST. PAUL HARBOR

Figure 4



ELEMENT NUMBERING OF ST. PAUL HARBOR

Figure 5



NODAL NUMBERING OF ST. PAUL HARBOR

Figure 6

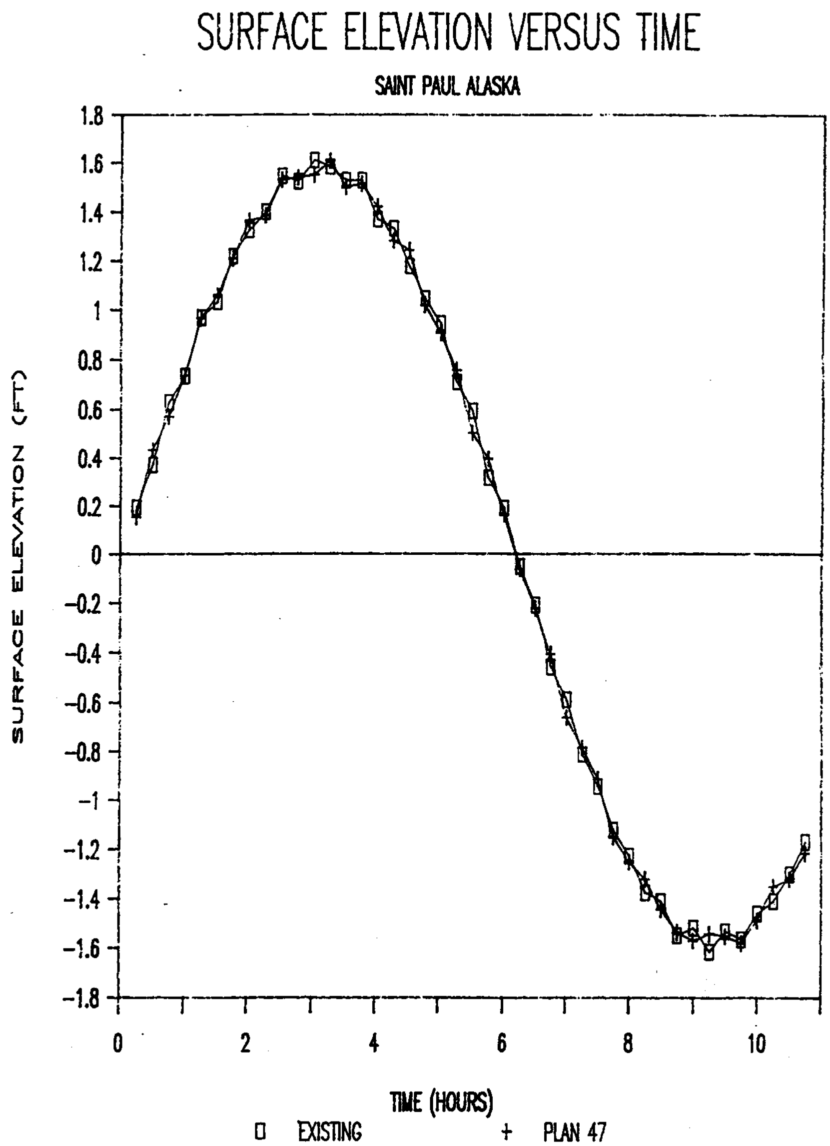

SURFACE ELEVATION VERSUS TIME
SAINT PAUL ALASKA
SURFACE ELEVATION (FT)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
0
2
4
6
8
10
TIME (HOURS)
EXISTING
PLAN 47

Figure 7

APPENDIX B
ECONOMIC ANALYSIS

Harbor Improvements
St. Paul, Alaska

CONTENTS

CONTENTS--Continued

Figures

FIGURES--Continued

FIGURES--Continued

Tables

TABLES--Continued

TABLES--Continued

APPENDIX B
ECONOMIC ANALYSIS

Harbor Improvements
St. Paul, Alaska

1. COMMUNITY DESCRIPTION

1.1 Study Area

St. Paul, one of the Pribilof Islands, is located in the eastern Bering Sea of Alaska. With a land area of 44 square miles, it is the largest and the northernmost of the five islands. Only two of the islands, St. Paul and St. George, are inhabited. St. George, approximately 50 miles southeast of St. Paul, has an estimated population of 138, compared to St. Paul's population of about 800.

1.2 Population

Of the 767 people living on St. Paul in 1995, approximately 66 percent were Alaska Natives. In former years the Native percentage was higher; during the late 1980's, some Natives migrated from St. Paul, and fish processing and construction have increased the number of non-Natives on the island. The population is predominately male; in 1995 males constituted 63 percent. Population levels since 1950 are listed in table B-1.1 with the average annual growth for each intervening decade.

TABLE B-1.1.--*Population statistics, St. Paul Island*

	YEAR					
	1950	**1960**	**1970**	**1980**	**1990**	**1995**
Population	195	350	455	551	763	767
Ave. annual growth		5.7%	2.6%	1.9%	0.9%	

1.3 Labor Force and Employment

In 1986, approximately 417 persons over the age of 16 resided on St. Paul Island, excluding uniformed U.S. Coast Guard personnel. Of this number, 71 percent were employed. This is probably as high a participation rate as can be expected in St. Paul, since some jobs are not filled under full employment conditions. For example, Unalaska residents were brought to St. Paul to work in fish processing. The remaining members of the relevant age group are those who are voluntarily not part of the labor force, such as students, retirees, and homemakers.

The economic environment of the Pribilof Islands is unique. Prior to October 1983, St. Paul was classified as a Government reservation. The island was the center of fur sealing activities under the administrative jurisdiction of the National Marine Fisheries Service (NMFS). Since the withdrawal of the NMFS in 1983, the community has had to find other sources of employment (table B-1.2). This withdrawal was an extreme setback, considering that the NMFS accounted for 60 percent of the total employment.

With the help of the Federal grant programs and newly established self-government, the community designed a program to develop a new economic base related to fisheries. The program has included construction of a breakwater and dock, expansion and upgrading of utility systems, repair and upgrading of the airport, and a myriad of training and small business assistance programs. St. Paul Island has been able to differentiate and regain some employment stability.

TABLE B-1.2.--*Resident employment, St. Paul Island*

	1980		1990	
	No. of jobs	**% employed in category**	**No. of jobs**	**% employed in category**
Forestry/fishing/farming	N/A		44	13.3
Construction	N/A		32	9.7
Manufacturing	N/A		71	21.5
Transportation	N/A		12	3.6
Communications/utilities	N/A		15	4.6
Trade	48	19.8	18	5.5
Service	20	8.3	13	3.9
Government				
Federal	145	59.9	36	10.9
State	13	5.4	18	5.5
Local	16	6.6	71	21.5
TOTALS	242	100	330	100

N/A = not available.

1.4 Government

1.4.1 City of St. Paul

The city of St. Paul was incorporated as a second-class city in 1971. On October 28, 1983, the National Marine Fisheries Service officially withdrew from St. Paul, leaving the island to its first true self-government. Congress appropriated $12 million for a trust fund for St. Paul as compensation for loss of the Federal agency and to promote self-sufficiency. The city was the recipient of the harbor development funds and has overseen construction of the harbor facility. Other responsibilities held by the city include updating and upgrading the Capital Improvement Programs, implementation of land use plans and management of the planning staff, assessment and provision of utility services, financial and accounting systems development, procurement of housing assistance funds, and numerous community services.

1.4.2 Public Health Service.

The Public Health Service operates the only medical facility on the island, providing health care to residents of St. Paul. The facility is staffed by one physician's assistant and one nurse practitioner; one community health representative; and two alcohol and mental health people. The support staff includes a receptionist, a bookkeeper, and a janitor. Surgical and other major medical cases are handled in Anchorage. The Public Health Service provides all the clinic's funding, about $500,000 a year. Staffing is adequate for current case loads; some of the staff also serve other communities around St. Paul.

1.4.3 Pribilof Island School District.

In 1996, St. Paul's school system served approximately 151 students in kindergarten through grade 12. There are 13 teachers and 8 aides. The student-to-teacher ratio is 11.6 to 1.

1.5 Public Services

Six infrastructure elements have been identified as essential to providing support services to potential users of harbor facilities on St. Paul. These are fuel and fuel storage, air transportation, power, water/sewer, housing, and roads.

1.5.1 Fuel Storage Facilities.

The city of St. Paul purchases fuel in bulk and operates fuel storage and distribution systems for the community. Using funds from the National Oceanic and Atmospheric Administration (NOAA), the city developed a 1-million-gallon diesel fuel tank farm in the late 1980's, with an intertie to the harbor and dock. This capacity was added to the city's previous fuel storage capacity of 700,000 gallons. In addition, the city acquired fuel tanks with a capacity of approximately 400,000 gallons from the Pribilof Off-Shore Service Camp located near the airport. These tanks were integrated into the city's overall fuel storage system. The U.S. Coast Guard has a 224,000-gallon Federal storage facility adjacent to the Loran station. In total, St. Paul Island has a fuel storage capacity of more than 2.3 million gallons.

1.5.2 Air Transportation.

St. Paul has a north-south oriented scoria runway, 150 feet wide by 5,800 feet long. The safety area of the runway is 300 feet by 7,000 feet. The island is serviced by Reeve Aleutian Airways (RAA), which makes three flights a week from Anchorage, and PenAir, which also makes three flights a week and services St. George. RAA has a building near the State-owned airport.

1.5.3 Electric Power.

Electric power for the village is produced by a relatively modern generating plant with six 150-kilowatt (kW) generators and two 350-kilovolt-ampere (kVA) generators. From the powerplant, located near the dock, most power is supplied throughout the village at 480 volts, three-phase. Electricity is available at the harbor. To meet forecasted demands and to increase revenues by extending service to airport-area customers, the utility has made the following commitments:

a. Secured a 2-percent loan from the Alaska Power Authority, a State agency, to extend service to the airport, new homes, and the new dock.

b. Secured a State grant to obtain and install a new 850-kW generator at the existing powerplant; and

c. Entered into a power purchase agreement with Flowind Corporation to purchase diesel and wind power at discounted rates.

1.5.4 Water.

St. Paul's water supply, storage, and distribution is maintained by the city. The water is pumped from two deep wells to three 200,000-gallon-capacity tanks on Telegraph Hill. The community uses an average of 60,000 to 80,000 gallons per day. Water service is available at the harbor docks.

1.5.5 Sewer.

A waste water collection and treatment/disposal system is located in the village. All homes are connected to the piped water and sewer system and are fully plumbed. The system includes two septic tanks and two leach fields. An outfall line was recently added for seafood processing waste. Vessels using the harbor are prohibited from discharging any wastes within the harbor area.

1.5.6 Housing.

According to the 1990 U.S. census, 153 residential units were occupied and 23 units were vacant. The Aleutian Housing Authority reports that 38 families applied for 20 new houses under construction, indicating that even with completion of the new units, 18 households will remain on a waiting list for future housing. The demand for future housing is also indicated by the number of persons residing at existing units. The community experienced a peak number of persons per unit in 1950 at 7.0. That number dropped to 4.2 in 1980, but had increased to 4.6 by 1985. The city was awarded a grant for planning the construction of up to 32 multifamily units.

According to the Department of Housing and Urban Development, construction costs on St. Paul, based on recent housing construction projects, run approximately $85 per square foot (excluding land costs). Examples include a 1,050-square-foot three-bedroom home with a construction cost of $90,000, and a 1,200-square-foot four-bedroom home that cost $102,000 to build.

1.5.7 Roads.

St. Paul Island currently has 35 miles of cinder-surfaced roads. Of these, 5 miles are within the village area, 4 miles are between the village and the airport, and the remaining 26 miles serve the remainder of the island. The road system is considered to be sufficient to serve all areas likely to be developed in the near future.

1.5.8 Marine Transportation.

The city of St. Paul constructed a 750-foot breakwater and 200 feet of dock in 1986. Under Section 204(e) of Public Law 99-662, the city constructed additional breakwater for the current harbor, completing it in 1990. The main breakwater was extended 1,050 feet, making it 1,800 feet in length. A 1,000-foot detached breakwater was added to the project. Several docks were added after the 1990 construction. The city added a 100-foot steel pile dock. The local village corporation, Tanadgusix (TDX), constructed a 200-foot dock with electric power. The dock is accessible by road, with approximately 1 acre of adjacent area for loading and temporary storage. Cargo comes by barge from Seattle five or six times a year.

1.5.9 Recreation.

The city operates a recreation center on the second floor of the city hall. The facility, open to the general public, provides a game room and organized recreational events, including bingo and dances. The city has a large picnic shelter and a playground.

2. MARINE RESOURCE ASSESSMENT

The eastern Bering Sea is known for its vast marine habitat and fisheries. Species that inhabit waters in the area include pollock, Pacific cod, yellowfin sole, rock sole, other flatfish, rockfish, sablefish (blackcod), red and blue king crab, and *bairdi* and *opilio* tanner crab.

Shellfish harvesting and processing is currently the most productive fishery in the St. Paul area. There is great potential for further development in groundfish fisheries and processing of various kinds of finfish. Trawl surveys were done by the North Pacific Fishery Management Council (NPFMC) within the Eastern Bering Sea/Aleutian Islands District (NPFMC 1993). According to these surveys, the Pribilof Area contains more than 90 percent of the pollock, 76 percent of the Pacific cod, 42 percent of the yellowfin sole, and 46 percent of the rock sole in the Eastern Bering Sea/Aleutian Islands District.

Marine resources in the eastern Bering Sea are managed by NPFMC and the Alaska Department of Fish and Game (ADF&G). These agencies are responsible for assessing and protecting the abundant resource. NPFMC manages the groundfish, and ADF&G manages the shellfish resources.

2.1 Responsible Institutions

Responsibility for management and development of the fishery resources in the study area is shared between foreign, Federal, State, and quasi-governmental agencies. In the United States, these agencies include the National Marine Fisheries Service (NMFS), the North Pacific Fishery Management Council (NPFMC), the Alaska Department of Fish and Game (ADF&G), and the International Pacific Halibut Commission (IPHC). In the Russian Far East, the main research, management, and development agency is called TINRO.

The Magnuson Fishery Conservation and Management Act of 1976 (Public Law 94-265, as amended), often referred to as the Magnuson Act, provides for the conservation and exclusive management of all fishery resources within the U.S. Exclusive Economic Zone (EEZ), by Presidential proclamation in 1983. The U.S. EEZ extends from the seaward boundaries of the territorial sea (3 nautical miles from shore) to 200 nautical miles offshore around the coast of the United States. The Magnuson Act does not abrogate State of Alaska responsibilities for jurisdiction of State waters (0 to 3 miles from shore). However, the act gave the Federal Government management authority over all living resources within the U.S. EEZ, as well as those anadromous species originating within the U.S. EEZ on the continental shelf which may occur outside 200 nautical miles. The act's intent is to develop effective management controls to conserve the fish and invertebrate stocks and to preserve the potential allocation to domestic fishermen.

Brief descriptions of key Federal agencies responsible for fishery resource allocation and management are provided in the following paragraphs.

2.1.1 National Marine Fisheries Service (NMFS).

The Alaska regional office of the NMFS is located in Juneau, Alaska. This office is responsible for planning and implementing fishery management conservation programs, including implementation of fishery management plans recommended by the North Pacific Fishery Management Council (NPFMC). The regional office also coordinates Federal and State resource management and research, monitors harvest, and sets openings and closures in federally managed fisheries. The Alaska Fishery Science Center in Seattle, Washington, along with its research laboratories on Kodiak Island and at Auke Bay, Alaska, plans and conducts fishery research studies to assess stock abundance, collect biological information, and study factors affecting production in the U.S. EEZ off Alaska and in adjoining international and foreign waters.

2.1.2 North Pacific Fishery Management Council (NPFMC).

The Magnuson Act created eight regional fishery management councils. The NPFMC has responsibility for fishery management in the U.S. EEZ off Alaska. This geographic area of authority includes fisheries in the U.S. EEZ of the Arctic Ocean, Bering, and Chukchi Seas, and the Pacific Ocean seaward of Alaska, including the Gulf of Alaska. The 15-member council regulates resources through fishery management plans developed with input from Federal, State, industry, environmental, and other interested parties. These plans serve as the base reference documents for management of fisheries within the U.S. EEZ, and contain detailed descriptions of stocks fished, participation, and management goals. Through amendments to these plans, fisheries are structured to meet the changing needs of society. The NPFMC makes management recommendations to the NMFS in the form of amendments that are then approved or rejected by the U.S. Department of Commerce.

The NPFMC also has responsibility for establishing annual harvest levels for target groundfish, for setting the non-target bycatch levels allowed in each fishery, and for recommending a percentage of the pollock total allowable catch (TAC) for Community Development Quotas (CDQ's). These recommendations are approved or rejected by the U.S. Department of Commerce. NMFS is responsible for regulating the U.S. EEZ fisheries to assure compliance with TAC's. The State of Alaska allocates CDQ's to local communities that file applications. Although crab and other shellfish are covered under the Magnuson Act, the Federal Government has allowed the State of Alaska, through the Board of Fisheries and the ADF&G, to manage these resources under the Federal fishery management plan.

2.1.3 Alaska Department of Fish and Game (ADF&G).

ADF&G is the research, management, and regulatory agency for the State of Alaska. Its activities are regulated by the Board of Fisheries, the policy-making arm of the State government. The Division of Commercial Fisheries within ADF&G is charged with research and management of commercial fisheries in Alaska waters (within 3 nautical miles of shore) and under agreement with the NMFS, crab and shellfish fisheries in the U.S. EEZ. ADF&G conducts research similar to that conducted by the NMFS and makes recommendations to the Board of Fisheries for area openings and closings to keep fishing within established harvest guidelines.

2.1.4 International Pacific Halibut Commission (IPHC).

The International Pacific Halibut Commission (IPHC) was established in 1923 by a convention between Canada and the United States for the preservation of Pacific halibut in the North Pacific Ocean and the Bering Sea. Three IPHC commissioners are appointed by the Governor General of Canada and three by the President of the United States. The commissioners appoint a director who supervises the scientific and administrative staff of the IPHC, located in Seattle, Washington. The IPHC conducts stock assessment surveys, collects biological data, and recommends policy and regulatory actions and harvest guidelines for approval by the two governments.

2.1.5 Russian Agencies.

Under the former Soviet government, the Ministry of Fisheries was responsible for nearly all aspects of the Russian fishing industry. The Ministry operated a number of regional companies under its auspices, including domestic and distant-water fisheries. Dalryba was the regional fishing company operating under the Ministry in the Russian Far East. In 1989, Dalryba was restructured to form an independent fishing enterprise, and the Yeltsin administration reallocated much of its quota establishment and fisheries management powers directly to the Ministry of Fisheries. In October 1992, the Ministry of Fisheries was officially downgraded from ministry to committee status and renamed the Committee of Fisheries of the Russian Republic.

TINRO is the research and management agency that controls the fishery resources of the Western Bering Sea adjacent to the study area. VINRO is the main fisheries research institute in Russia, with subsidiary institutes operating in each region. In the Russian Far East, TINRO is the fisheries research organization responsible for monitoring status of the stocks, collecting and analyzing harvest and processing data, and advising the Fisheries Committee on establishing annual quota allocations for each species and area.

Each year TINRO makes a prognosis of stock abundance and acceptable harvest for each fish and invertebrate stock in the area. This information is first given to the Federal Committee for Protection of the Environment, then passed on to the Federal Committee on Fisheries for its approval. When the total allowable catch for the region is approved by the Federal Committee on Fisheries, fishing and processing companies in the region make their requests for quotas to a local Committee on Fisheries which is a department of the local government, such as the Primorskiy region of the Kamchatka district. The local committee reviews the application based on several criteria, including (a) the company's past performance, (b) importance to the local fishing industry and the regional economy, and (c) the company's ability to actually use the requested quota, *i.e.* the number of its vessels and condition of its fleet, processing technology, domestic or foreign market contacts, and business management abilities.

If the company passes the local committee's quota request evaluation process, its request is passed on to a local fishing council made up of members of the fishing industry in the region. The local council approves the fishing quotas for each company by area, species, and region and then forwards the combined requests of all companies in the area to the Far Eastern Regional Scientific and Fishing Council. This council is composed of representatives of the seven regional governments, TINRO, one representative from each fishing company in the region, and Rybvod (fishing inspection organization). The Far Eastern Regional Scientific and Fishing Council gives the final regional approval for the fishing quota request and passes it on to the Federal Committee on Fisheries in Moscow for confirmation.

The Federal Committee issues a federal order which states the limits of harvest on each of the species in each area and indicates quotas allocated by company or district government. A copy of the order is sent to each of the regional organizations and regional governments, each of the companies that requested quotas, and to Rybvod, who along with the Border Guard is responsible for monitoring and enforcement of fishing regulations within the Russian 200-mile EEZ. TINRO is allocated a quota of the resource to fund agency operations. A Russian fishing company can also apply for fishing quota directly to the Federal Committee on Fisheries if the quota it is seeking is part of an international exchange quota from a bilateral foreign treaty agreement, or if it is part of an approved joint-venture operation with a foreign company. Regional governments and TINRO are allowed to sell their fishing quotas to Russian companies, or to foreign companies if no Russian companies are available or willing to purchase them, and to use the proceeds for scientific research, charity, or operational needs.

2.2 General Status of Alaska Marine Fishery Stocks

Overall, the major marine fishery stocks off Alaska are relatively abundant and healthy, with increasing or stable trends in abundance (table B-2.1). Of particular importance to the Pribilof Islands region are the major commercial resources of the Eastern Bering Sea. The marine resources of this area are also relatively abundant and healthy, with the exception of king crab, pink shrimp, and sablefish (table B-2.2 and figure B-2.1). The total harvest of all marine fishery resources off Alaska in 1994 was estimated at 5.4 billion pounds, worth $1.45 billion ex-vessel value. This represents more than 50 percent of the total landings in the United States and 38 percent of the ex-vessel

TABLE B-2.1.--*Biomass, total allowable catch (TAC) or harvest prediction, acceptable biological catch (ABC), actual harvest, and current status and trends of major marine resources in the EEZ off Alaska, 1995*

		TOTAL ALLOWABLE CATCH AND HARVEST (1)				STATUS OF RESOURCE	
SPECIES	1995 BIOMASS (6)	1995 ABC	1994 TAC/Pred (2)	1994 HARVEST	1995 TAC/Pred (2)	CONDITION OF RESOURC	TREND IN RESOURCES ABUNDANCE
Pollock	9,264,000	1,394,060	1,496,750	1,481,974	1,372,960	EBS/AI-Average, GOA-Low	EBS/AI-Stable, GOA-Decreasing
Pacific cod	2,193,000	397,200	241,400	244,598	319,200	EBS/AI-Average, GOA-High	EBS/AI-Increasing, GOA-Decreasing
Flatfish	9,622,470	1,303,990	378,525	298,085	401,167	EBS/AI-Very High, GOA-Unknow	EBS/AI-Increasing, GOA-Uncertain
Rockfish	1,020,111	50,265	43,207	35,178	41,648	EBS/AI-Low, GOA-Low	EBS/AI-Stable, GOA-Increasing
Sablefish	225,300	25,300	28,840	23,875	25,300	EBS/AI-Average, GOA-Average	EBS/AI-Increasing, GOA-Stable
Atka Mackerel	846,000	128,240	71,505	73,099	83,240	EBS/AI-High, GOA-Unknown	EBS/AI-Stable, GOA-Uncertain
Other Groundfish	682,000	30,710	39,581	28,586	34,226	EBS/AI-High, GOA-Unknown	EBS/AI-Increasing, GOA-Uncertain
Total Groundfish	23,831,881	3,329,765	2,299,608	2,185,395	2,277,741	EBS/AI-High, GOA-Low	EBS/AI-Stable, GOA-Stable/Decreasing
Halibut (8)	87,906	17,282	21,500	20,679	17,245	EBS/AI-Avg, GOA-Avg	EBS/AI-Decreasing, GOA-Increasing
Salmon (3)	(4)	(4)	167,000,000	197,000,000	147,000,000	EBS/AI-High, GOA-High	EBS/AI-Stable, GOA-Stable/Decreasing
King Crab (5)	(4)	(4)	(4)	3,865	(4)	EBS/AI-V. Low, GOA-V. Low	EBS/AI-Decreasing, GOA-Stable
Tanner Crab (9)	(4)	(4)	72,065	73,155	(4)	EBS/AI-Avg, GOA-Low	EBS/AI-Decreasing, GOA-Stable
Dungeness Crab	(4)	(4)	1,987	635	1,500	GOA-Avg/Low	GOA-Stable
Pink Shrimp	(4)	(4)	900	1,179	1,200	EBS/AI-V. Low, GOA-V. Low	EBS/AI-Stable, GOA-Stable
Herring (7)	(4)	(4)	61,741	43,401	44,270	EBS/AI-High, GOA-Avg	EBS/AI-Stable, GOA-Stable

Note 1: Unless otherwise indicated quotas and harvest values are givem in metric tons.
Note 2: Total groundfish TAC includes reserves for all species.
Note 3: Salmon predicted and actual run size and catches given in number of fish.
Note 4: Prediction and/or mid-season quotas not available for all Alaska areas.
Note 5: Combines calendar year and split year seasons for some species.
Note 6: Exploitable biomass for some species unknown.
Note 7: Includes roe and roe on kelp harvests & predictions in short tons.
Note 8: Exploitable biomass and harvest of halibut for Alaska only.
Note 9: Includes 1993/94 T. bairdi and excludes Nov/Dec 1994 T. bairdi catch.

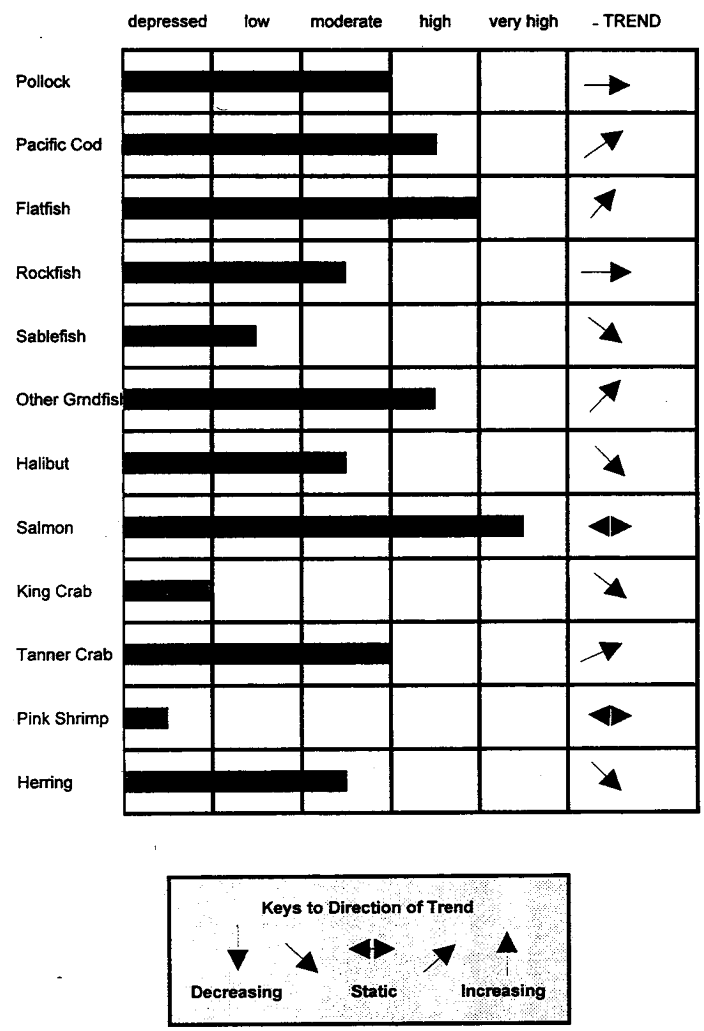
Sources: NMFS, ADF&G, and NRC.
GOA = Gulf of Alaska.
EBS/AI = Eastern Bering Sea/Aleutian Islands.

TABLE B-2.2.--*Biomass, total allowable catch (TAC) or harvest prediction, acceptable biological catch (ABC), actual harvest, and current status and trends of major resources in the Eastern Bering Sea/Aleutian Islands*

		TOTAL ALLOWABLE CATCH AND HARVEST (mt)				STATUS OF RESOURCE	
SPECIES	1995 BIOMASS (1)	1995 ABC	1994 TAC (2)	1994 HARVES	1995 TAC (3)	CONDITION OF RESOURCE	TREND IN ABUNDANCE
Pollock (EBS)	8,080,000	1,250,000	1,330,000	1,313,135	1,250,000	Average	Stable
(AI)	189,000	56,600	56,600	57,097	56,600	Average(?)	Stable(?)
Bogoslof (518)	442,000	22,100	850	922	1,000	Low	Stable
Pacific cod	1,620,000	328,000	191,000	196,569	250,000	Average	Increasing
Yellowfin Sole	2,770,000	277,000	170,325	144,544	190,000	High	Increasing
Greenland Turbot	150,000	7,000	7,000	10,321	7,000	Low	Declining
Arrowtooth Flounder	625,000	113,000	10,000	14,366	10,227	High	Increasing
Rock Sole	2,330,000	347,000	63,750	60,544	60,000	High	Increasing
Flathead Sole	725,000	138,000	(4)	(4)	30,000	High	Stable
Other Flatfishes	677,000	117,000	47,600	29,766	19,540	High	Stable
Sablefish (EBS)	16,500	1,600	540	699	1,600	Low	Increasing
(AI)	13,900	2,200	2,800	1,745	2,200	Average	Declining
ific Ocean Perch (EBS)	47,100	1,850	1,910	1,906	1,850	Low	Stable
(AI)	252,000	10,500	10,900	10,932	10,500	Low	Stable
POP Complex (EBS)(4)	29,700	1,400	1,190	127	1,260	Unknown	Unknown
Sharp/Northern (AI)	94,500	5,670	5,670	5,090	5,103	Unknown	Unknown
Short/Rougheye (AI)	45,000	1,220	1,037	935	1,098	Unknown	Unknown
Other Rockfish (EBS)	7,300	365	310	133	329	Average	Stable
(AI)	15,500	770	655	297	693	Average	Stable
Atka Mackerel	825,000	125,000	68,000	69,559	80,000	High	Stable
Squid	Unknown	3,110	2,644	588	1,000	Unknown	Unknown
Other Species	682,000	27,600	22,432	24,518	20,000	High	Increasing
Total Groundfish	19,636,500	2,836,985	1,995,213	1,943,793	2,000,000	High	Stable

Note 1: Exploitable biomass for some species unknown.
Note 2: 1994 TAC includes the final allocated portion of the15% reserve allocation & CDQ quota and catch
Note 3: 1995 TAC includes the 15% reserve allocation.
Note 4: Flathead sole was grouped with other flatfish in 1994 allocation.

Source: NMFS, ADF&G, and NRC projections.



Sources: NMFS, ADF&G and NRC.

FIGURE B-2.1.—Relative status of major commercial fishery stocks and projected trend in abundance for the Eastern Bering Sea/Aleutian Islands, 1995.

value. Groundfish represents about 60 percent of the total landed ex-vessel value, crab and other shellfish account for 35 percent, and salmon account for 5 percent. The volume and value of seafood harvested from marine waters has increased each year since 1990.

2.3 Crab

2.3.1 Introduction.

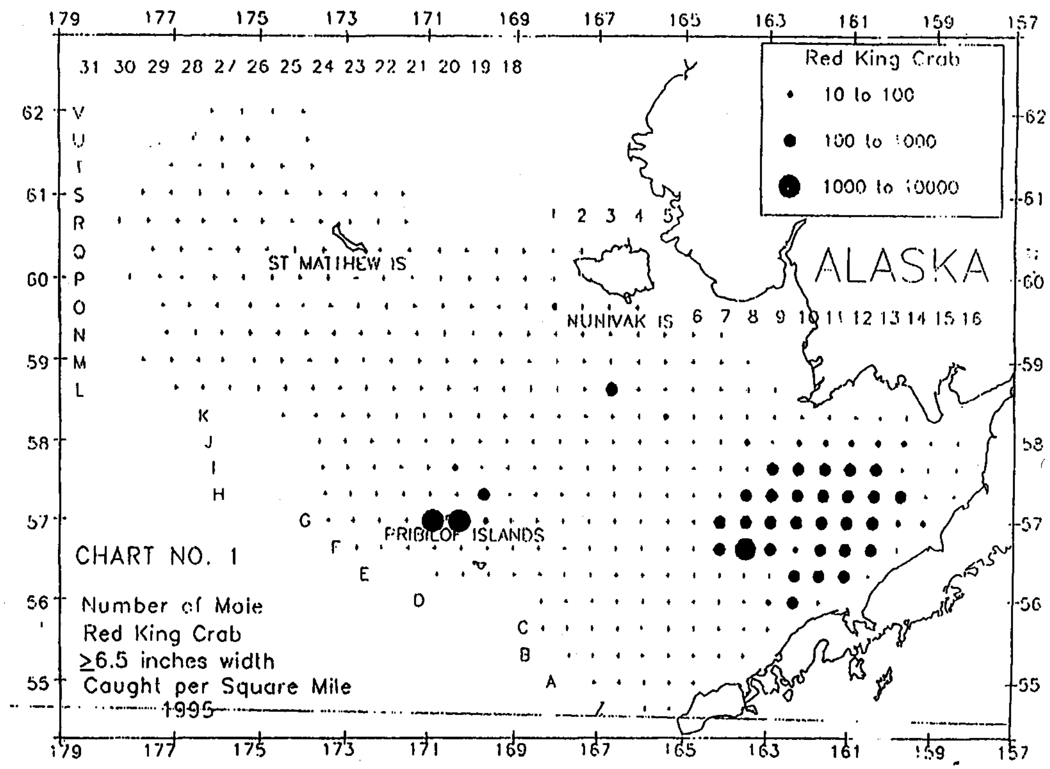
Red and blue king crab, *opilio* and *bairdi* tanner crab, and Korean horsehair crab are the major crab species taken in the vicinity of the study area. Nearly all of the blue king, *opilio* tanner, and horsehair crab taken in Alaskan waters are harvested near St. Paul. As red king crab abundance and harvests have declined since the early 1980's, both *bairdi* and *opilio* tanner crab have become much more important to the commercial crab fishing industry in Alaska. Although highly variable in abundance from season to season, crab stocks in the vicinity of the study area have continued to support an active commercial crab industry in Alaska.

Of particular importance to St. Paul are the Pribilof District red king crab fishery, the St. Matthew Island blue king crab fishery, the Bering Sea *opilio* tanner crab fishery, and the Bering Sea Korean horsehair crab fishery. Crab processing operations at St. Paul Harbor will continue to depend largely upon harvests of *opilio* tanner crab from the U.S. and, likely, the Russian zone of the Western Bering Sea. Some *bairdi* tanner crab, red and blue king crab, and hair crab will also be processed at St. Paul, but in relatively minor quantities and at harvest values significantly lower than the *opilio* tanner crab prospects.

2.3.2 Red King Crab.

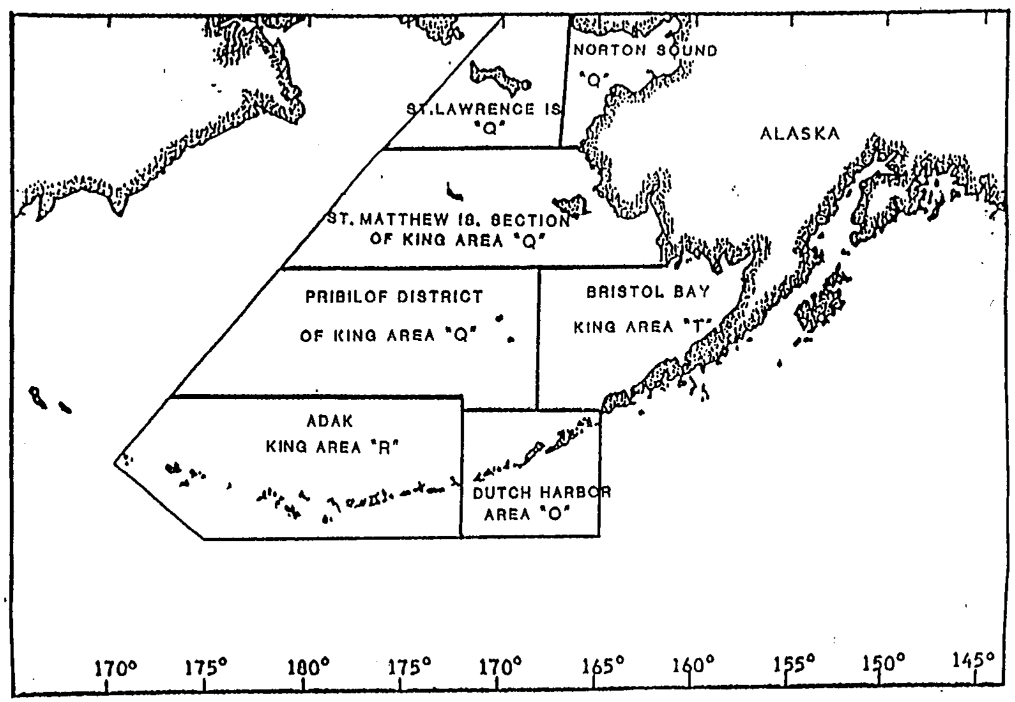
Distribution and Abundance. Red king crab are most abundant in Bristol Bay and around the Pribilof Islands (figure B-2.2). These two populations are managed separately, with individual fishery seasons (figure B-2.3). The trend in red king crab abundance has declined significantly from more than 365.3 million crab in 1977 to about 34 million crab in 1994 (table B-2.3 and figure B-2.4). The abundance of red king crab in the Pribilof area has increased sufficiently to allow a small (1.9 million lb in 1995) mixed blue and red king crab fishery in this area since 1993. The trend in abundance for Bristol Bay red king crab is not promising. The near-term prognosis is for continued relatively low abundance in Bristol Bay and little if any allowable harvest. The prognosis for Pribilof Island red king crab is somewhat more optimistic. Although at relatively low abundance, red king crab in the Pribilof District have increased in abundance over the past 4 years, and the general trend is for slowly increasing abundance and harvests similar to those allowed in 1993-1995.

Harvest and Value. The Bristol Bay red king crab fishery, when open, is conducted in November. Recently, the season has lasted between 7 and 10 days. Only male red king crab with 6.5 inches carapace width and over are allowed to be



Source: NMFS.

FIGURE B-2.2.--Catch per unit effort (numbers per square mile) of legal adult male red king crab in the Eastern Bering Sea, 1995.



Source: ADF&G.

FIGURE B-2.3.-- Alaska Department of Fish and Game king crab management areas in the Eastern Bering Sea.

TABLE B-2.3.--*Annual abundance estimates (millions of pounds) for red king crab (P. camtschaticus) from NMFS surveys*

	Males				Females			
	Juveniles	Pre-rec	Legal		Small	Large		
Size[1](mm)	<110	110-134	≥135	Total	<90	≥90	Total	Grand Total
Width(in)	<5.2	5.2-6.5	≥6.5		<4.3	≥4.3		
1975	84.9	31.7	21.0	137.6	70.8	58.9	129.7	267.3
1976	70.2	49.3	32.7	152.2	35.9	71.8	107.7	259.9
1977	80.2	63.9	37.6	181.7	33.5	150.1	183.6	365.3
1978	62.9	47.9	46.6	157.4	38.2	128.4	166.6	324.0
1979	48.1	37.2	43.9	129.2	45.1	110.9	156.0	285.2
1980	56.8	23.9	36.1	116.8	44.8	67.6	112.5	229.3
1981	56.6	18.4	11.3	86.3	36.3	67.3	103.6	189.9
1982	107.2	17.4	4.7	129.3	77.2	54.8	132.0	261.3
1983	43.3	10.4	1.5	55.2	24.3	9.7	34.0	89.2
1984	81.8	12.6	3.1	97.6	57.6	17.6	75.1	172.7
1985	13.7	10.1	2.5	26.3	6.9	6.8	13.7	39.9
1986	11.8	12.3	5.9	30.1	4.5	5.4	9.8	39.9
1987	20.1	12.6	7.9	40.6	16.8	18.3	35.1	75.7
1988	8.5	6.4	6.4	21.3	2.7	15.7	18.4	39.7
1989	8.6	9.4	11.9	29.9	4.4	16.9	21.2	51.1
1990	8.2	10.2	9.2	27.6	7.2	17.5	24.7	52.2
1991	8.1	6.4	12.0	26.5	4.7	12.6	17.4	43.9
1992	7.0	5.5	5.8	18.3	2.2	13.4	15.6	33.9
1993	5.7	10.2	9.8	25.8	2.5	19.2	21.7	47.5
1994 (B)[2]	5.9	6.0	5.5	17.4	3.4	7.5	10.9	28.4
(P)	0.2	0.7	2.0	3.0	0.0	2.6	2.6	5.6
Limits[3]								
Lower	0.0	3.3	3.5	9.2	0.0	4.2	4.4	13.6
Upper	12.7	8.6	7.5	25.6	9.0	10.9	17.5	43.1
±%	113	44	37	47	165	44	60	52

[1] Carapace length (mm).
[2] Separate estimates given for Bristol Bay (B) and Pribilofs (P) Districts.
[3] Mean ± 2 standard errors for most recent year; Bristol Bay only.

Note: Bristol Bay and Pribilof Districts are combined except where noted.
Source: NMFS.

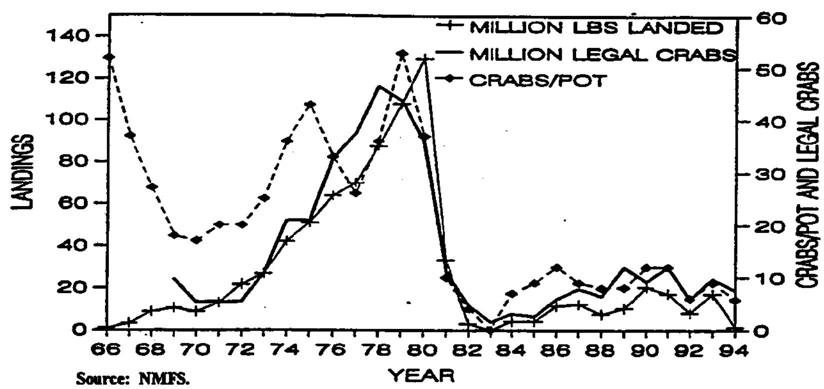


*FIGURE B-2.4.—U.S. landings in millions of pounds, CPUE (catch per unit of effort) as crabs/pot, and abundance of legal red king crab (*P. camtschaticus*) in millions in Bristol Bay and Pribilof District, estimated from NMFS trawl surveys (1994 CPUE from Pribilofs only).*

retained. Little if any of the red king crab harvested in Bristol Bay has been landed for processing in the Pribilof Islands. Bristol Bay red king crab is processed on the grounds by catcher/processor vessels and motherships, or delivered live to Dutch Harbor. The harvest of red king crab in Bristol Bay has declined from more than 128 million pounds in 1980 to zero in 1983, 1994, and 1995 when the fishery was closed due to low stock abundance (table B-2.4 and figure B-2.5). The total value of the Bristol Bay red king crab fishery in Alaska declined from $115 million in 1980 to between $40 million and $55 million in the past few years prior to the 1994 fishery closure. Average ex-vessel value of the Bristol Bay red king crab fishery declined from over $650,000 per year in the late 1970's to about $189,000 in 1993.

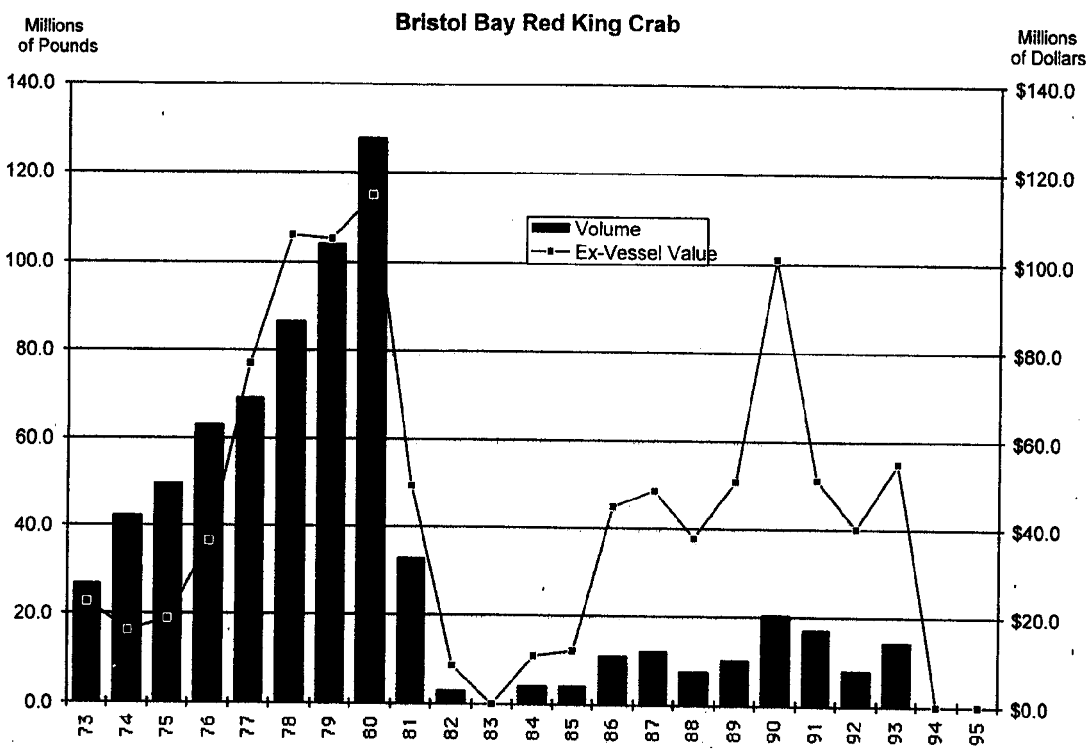
2.3.3 Blue King Crab.

Distribution and Abundance. Blue king crab are distributed around the Pribilof and St. Matthew Islands (figure B-2.6). Blue king crab near the Pribilof Islands are managed separately in the Pribilof District and recently have been harvested in a mixed-stock red and blue king crab fishery. The blue king crab located near St. Matthew are considered to be in the Northern District and are managed separately in a distinct fishery that runs concurrently with the Pribilof District fishery. The abundance of blue king crab in the Pribilof District has ranged from nearly 8 million crab in 1990 to between 5 and 6 million crab recently (table B-2.5). In the Northern District, blue king crab abundance has varied significantly from year to year, ranging

TABLE B-2.4.-- *Effort (number of vessels), total catch, average catch per vessel, ex-vessel price, total ex-vessel value, and average per-vessel value for Bristol Bay red king crab, 1973-95*

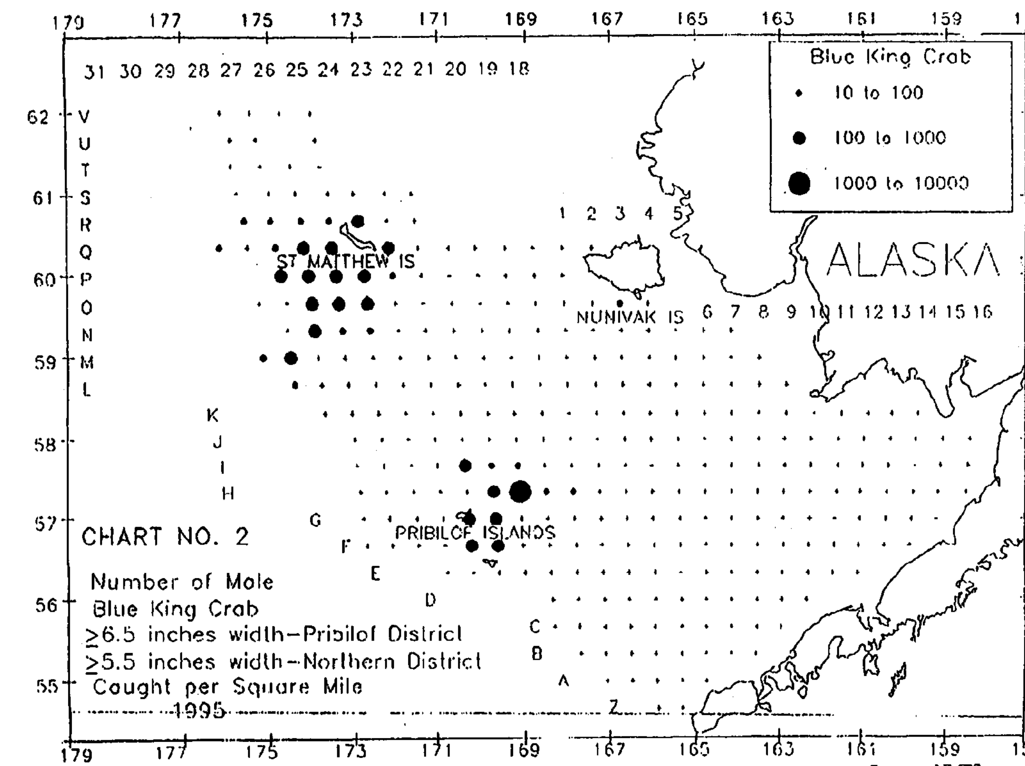
Year	Number Vessels	Total Catch (1) (lbs)	Average Per Vessel Catch (lbs/vessel)	Ex-Vessel Price ($/lb)	Total Annual Ex-vessel Value ($)	Average Per Vessel Value ($/vessel)
1973	67	26,913,636	401,696	$0.84	$22,607,454	$337,425
1974	104	42,266,274	406,406	$0.38	$16,061,184	$154,434
1975	102	49,686,776	487,125	$0.38	$18,880,975	$185,108
1976	141	63,044,401	447,123	$0.58	$36,565,753	$259,332
1977	130	69,237,589	532,597	$1.11	$76,853,724	$591,182
1978	162	86,345,283	532,996	$1.23	$106,204,698	$655,585
1979	236	104,272,166	441,831	$1.01	$105,314,888	$446,250
1980	236	128,089,795	542,753	$0.90	$115,280,816	$488,478
1981	177	32,880,079	185,763	$1.50	$49,320,119	$278,645
1982	90	2,905,376	32,282	$3.05	$8,861,397	$98,460
1983			Commercial Fishery Closed			
1984	89	4,146,805	46,593	$2.60	$10,781,693	$121,143
1985	128	4,168,517	32,567	$2.90	$12,088,699	$94,443
1986	159	11,109,807	69,873	$4.05	$44,994,718	$282,986
1987	236	12,168,679	51,562	$4.00	$48,674,716	$206,249
1988	200	7,364,258	36,821	$5.10	$37,557,716	$187,789
1989	211	10,183,457	48,263	$5.00	$50,917,285	$241,314
1990	240	20,245,815	84,358	$5.00	$101,229,075	

Source: ADF&G Westward Region Shellfish Reports.



Source: ADF&G Westward Region Shellfish Reports.

FIGURE B-2.5.--Total catch and ex-vessel value for Bristol Bay red king crab, 1973-95.



Source: NMFS.

FIGURE B-2.6.--Catch per unit effort (numbers per square mile) of legal adult male blue king crab in the Eastern Bering Sea, 1995.

TABLE B-2.5.—*Annual abundance estimates (millions of crabs) for blue king crab* (P. platypus) *in the Pribilof District from NMFS surveys*

Pribilof District

	Males				Females			
	Juveniles	Pre-rec	Legal		Small	Large		Grand
Size[1](mm)	<110	110-134	≥135	Total	<90	≥90	Total	Total
Width(in)	<5.2	5.2-6.5	≥6.5		<4.3	≥4.3		
1974	4.4	3.1	1.9	9.4	0.6	10.9	11.5	20.9
1975	4.1	8.0	7.5	19.6	0.0	8.8	8.8	28.4
1976	10.3	2.1	3.9	16.3	0.4	17.7	18.1	34.4
1977	3.2	2.2	9.4	14.8	2.2	17.5	19.7	34.5
1978	1.2	5.8	4.3	11.3	0.3	35.5	35.8	47.1
1979	6.4	1.5	4.6	12.5	5.2	2.9	8.1	20.6
1980	1.9	1.4	4.2	7.5	0.8	101.9	102.7[2]	110.2
1981	4.8	1.4	4.2	10.4	3.4	11.6	15.0	25.4
1982	1.2	0.7	2.2	4.1	0.7	8.6	9.3	13.4
1983	0.6	0.8	1.3	2.8	0.2	9.2	9.4	12.2
1984	0.5	0.3	0.6	1.3	0.3	3.1	3.4	4.8
1985	0.06	0.16	0.32	0.54	0.18	0.52	0.70	1.24
1986	0.02	0.02	0.43	0.47	0.04	1.86	1.90	2.37
1987	0.57	0.08	0.73	1.38	0.39	0.58	0.97	2.35
1988	1.10	0.0	0.20	1.29	0.77	0.43	1.20	2.49
1989	3.21	0.10	0.22	3.54	2.29	1.28	3.57	7.11
1990	1.84	1.24	0.41	3.48	1.82	2.66	4.48	7.96
1991	1.32	1.03	1.01	3.36	0.56	2.80	3.37	6.73
1992	1.57	1.17	1.02	3.76	1.31	2.05	3.36	7.11
1993	0.97	0.83	0.98	2.78	0.33	2.17	2.50	5.28
1994	0.31	0.51	0.76	1.57	0.06	4.28	4.34	5.91
Limits[3]								
Lower	0.1	0.2	0.2	0.6	0.0	0.6	0.7	1.2
Upper	0.5	0.9	1.3	2.6	0.1	7.9	8.0	10.6
±%	77	70	68	65	139	85	84	79

[1] Carapace length (mm).
[2] Female estimates considered unreliable in 1980.
[3] Mean ± 2 standard errors for most recent year.

from 14.6 million crab in 1993 to about 6 million in 1994 (table B-2.6). Variable trends in abundance of blue king crab over time are shown in figure B-2.7 for the Pribilof District and in figure B-2.8 for the Northern District. The prognosis for blue king crab abundance is questionable, given the variable trends in abundance displayed over the last 5 years. Based on abundance of pre-recruit males in both populations, any increase in allowable harvests over the foreseeable future is unlikely.

Harvest and Value. The St. Matthew (Northern District) blue king crab and Pribilof District mixed king crab fisheries are conducted concurrently in mid-September each year. Recently, the seasons have lasted about 7 days. Only male blue king crab with a carapace width of 5.5 inches or larger are allowed to be retained. Nearly all of the blue king crab harvested in the Northern District is processed on the fishing grounds by catcher/processors and motherships. Very little, if any, of this product is delivered to the Pribilof Islands for processing. The harvest of mixed red and blue king crab in the Pribilof District fishery declined from more than 10.5 million pounds in the 1980/81 season to a complete closure of the fishery between the 1988/89 and the 1992/93 seasons due to low stock abundance (table B-2.7). Since the fishery was reopened in 1993, harvests have averaged from 1.3 to 2.6 million pounds. At present, only about 450,000 pounds of this harvest is landed at St. Paul Island for processing. The remainder is processed at sea by catcher/processors and motherships. The Pribilof District fishery has had a recent ex-vessel value of between $6 million and $12 million, with an average annual value per vessel of between $51,000 and $116,000 (figure B-2.9). The St. Matthew or Northern District blue king crab fishery has produced relatively stable harvests of about 3 million pounds in recent years (table B-2.8). The average ex-vessel value of the fishery has fluctuated more than the harvest volume due to price, ranging from $14.9 million in 1994 to a projected $7.1 million in 1995 (figure B-2.10). The average value per vessel has ranged from a high of $171,000 in 1994 to a projected $79,290 in 1995 due to price decreases. With the downward pressure on the wholesale price of king crab in Asian markets from increased lower-cost supplies from the Russian Far East, it is unlikely that prices of blue or red king crab from Alaska will rebound to their level of recent years in the foreseeable future.

2.3.4 **Bairdi *Tanner Crab.***

Distribution and Abundance. *Bairdi* tanner crab are distributed primarily along the northern coast of the Alaska Peninsula from the continental shelf edge to Bristol Bay and near the Pribilof Islands (figure B-2.11). Overall abundance of *bairdi* tanner declined significantly from nearly 950 million crab in 1989 to less than 200 million in 1994 (table B-2.9). Large male *bairdi* tanner crab have also declined by about one-half, from 53.7 million in 1990 to about 20 million in 1994 (figure B-2.12). Based on the abundance of juvenile and pre-recruits, the prognosis for this stock is for continued decline in abundance in the near future.

TABLE B-2.6.–*Annual abundance estimates (millions of crabs) for blue king crab* (P. platypus) *in the Northern District (St. Matthew Island) from NMFS surveys*

Northern District

	Males				Females			
	Juveniles	Pre-rec	Legal		Small	Large		
Size[1](mm)	<105	105-119	≥120	Total	<80	≥80	Total	Grand Total
Width(in)	<4.3	4.3-5.5	≥5.5		<3.8	≥3.8		
1978	5.6	2.4	1.8	9.8	0.8	0.4	1.2	11.0
1979	4.9	2.3	2.2	9.4	1.7	0.9	2.6	12.0
1980	3.4	2.2	2.5	8.1	0.8	2.2	3.0	11.1
1981	1.2	1.8	3.1	6.3	0.0	0.5	0.5	6.8
1982	3.2	2.6	6.8	12.5	0.4	0.7	1.1	13.7
1983	1.8	1.6	3.5	6.9	0.2	2.4	2.7	9.6
1984	1.4	0.6	1.6	3.6	0.2	0.5	0.7	4.3
1985	0.46	0.35	1.08	1.89	0.08	0.13	0.21	2.10
1986	0.56	0.40	0.38	1.34	0.25	0.06	0.31	1.65
1987	1.07	0.73	0.74	2.53	0.46	0.22	0.68	3.21
1988	1.44	0.65	0.83	2.92	0.90	0.79	1.70	4.62
1989	4.80	0.97	1.48	7.25	1.58	1.68	3.27	10.52
1990	1.44	0.75	1.66	3.85	0.45	0.20	0.65	4.50
1991	2.92	1.52	2.17	6.61	0.84	0.69	1.53	8.14
1992	2.26	1.47	2.30	6.03	0.94	0.38	1.70	7.73
1993	4.62	1.99	3.60	10.22	1.35	3.03	4.38	14.60
1994	1.55	1.42	2.47	5.44	0.11	0.40	0.51	5.95
Limits[2]								
Lower	0.8	0.6	1.6	3.5	0.0	0.1	0.1	3.6
Upper	2.3	2.2	3.4	7.4	0.3	0.7	0.9	8.3
±%	46	57	36	36	141	75	74	39

[1] Carapace length (mm); categories reflect smaller average size in the Northern District; 80 mm is the median size at maturity for females.

[2] Mean ± 2 standard errors for most recent year.

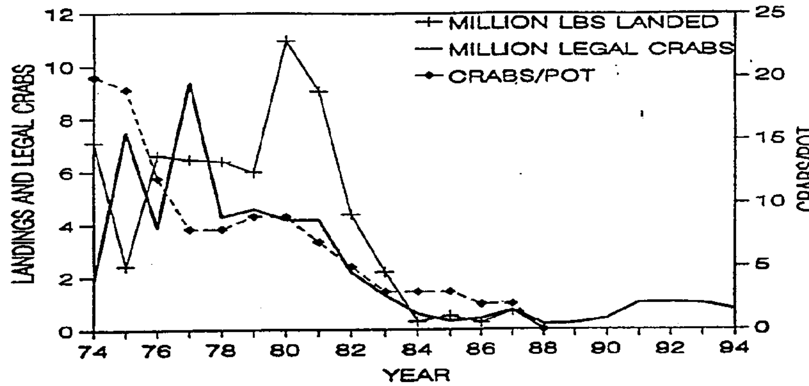


FIGURE B-2.7.—U.S. landings in millions of pounds, CPUE as crabs/pot, and abundance of legal blue king crab (P. platypus) *in the Pribilof District, estimated from NMFS trawl surveys.*

Northern District

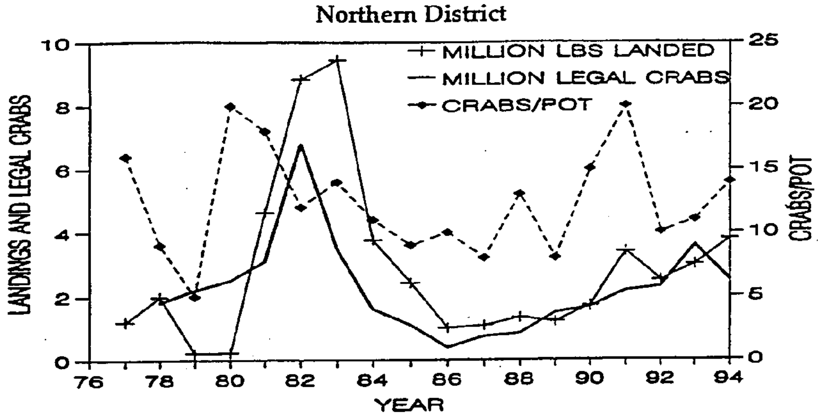


FIGURE B-2.8.—U.S. landings in millions of pounds, CPUE as crabs/pot, and abundance of legal blue king crab (P. platypus) *in the Northern District (St. Matthew Island), estimated from NMFS trawl surveys.*

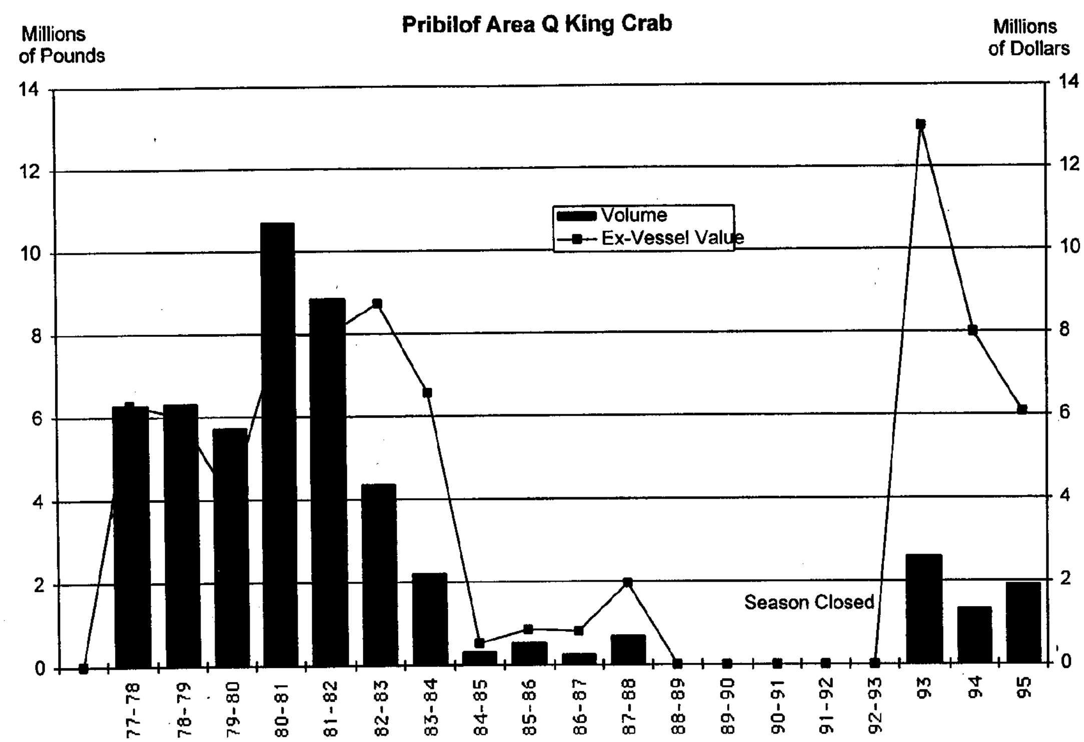
TABLE B-2.7.-- *Effort (number of vessels), total catch, average catch per vessel, ex-vessel price, total ex-vessel value, and average per-vessel value for Pribilof District king crab, 1977/78-95*

Pribilof Red and Blue King Crab Area "Q"

Year	Number Vessels	Total Catch (1) (lbs)	Average Per Vessel Catch (lbs/vessel)	Ex-Vessel Price ($/lb)	Total Annual Ex-vessel Value ($)	Average Per Vessel Value ($/vessel)
1977-78	34	6,297,469	185,220	$1.00	$6,297,469	$185,220
1978-79	58	6,332,372	109,179	$0.95	$6,015,753	$103,720
1979-80	46	5,710,676	124,145	$0.70	$3,997,473	$86,902
1980-81	110	10,683,061	97,119	$0.75	$8,012,296	$72,839
1981-82	99	8,830,030	89,192	$0.90	$7,947,027	$80,273
1982-83	122	4,353,650	35,686	$2.00	$8,707,300	$71,371
1983-84	126	2,188,833	17,372	$3.00	$6,566,499	$52,115
1984-85	16	306,699	19,169	$1.75	$536,723	$33,545
1985-86	26	525,235	20,201	$1.60	$840,376	$32,322
1986-87	16	253,489	15,843	$3.20	$811,165	$50,698
1987-88	38	691,427	18,195	$2.85	$1,970,567	$51,857
1988-89			Commercial Fishery Closed			
1989-90			Commercial Fishery Closed			
1990-91			Commercial Fishery Closed			
1991-92			Commercial Fishery Closed			
1992-93			Commercial Fishery Closed			
1993	112	2,607,634	23,282	$4.98	$12,986,017	$115,947
1994	104	1,336,024	12,846	$6.00	$8,016,144	$77,078
1995 (2)	119	1,916,000	16,101	$3.18	$6,089,720	$51,174

(1) Catch and value figures exclude deadloss.
(2) 1995 catch and value figures are preliminary.

Source: ADF&G Westward Region Shellfish Reports.



Source: ADF&G Westward Region Shellfish Reports.

FIGURE B-2.9.--Total catch and ex-vessel value for Pribilof District red and blue king crab, 1977/78-95.

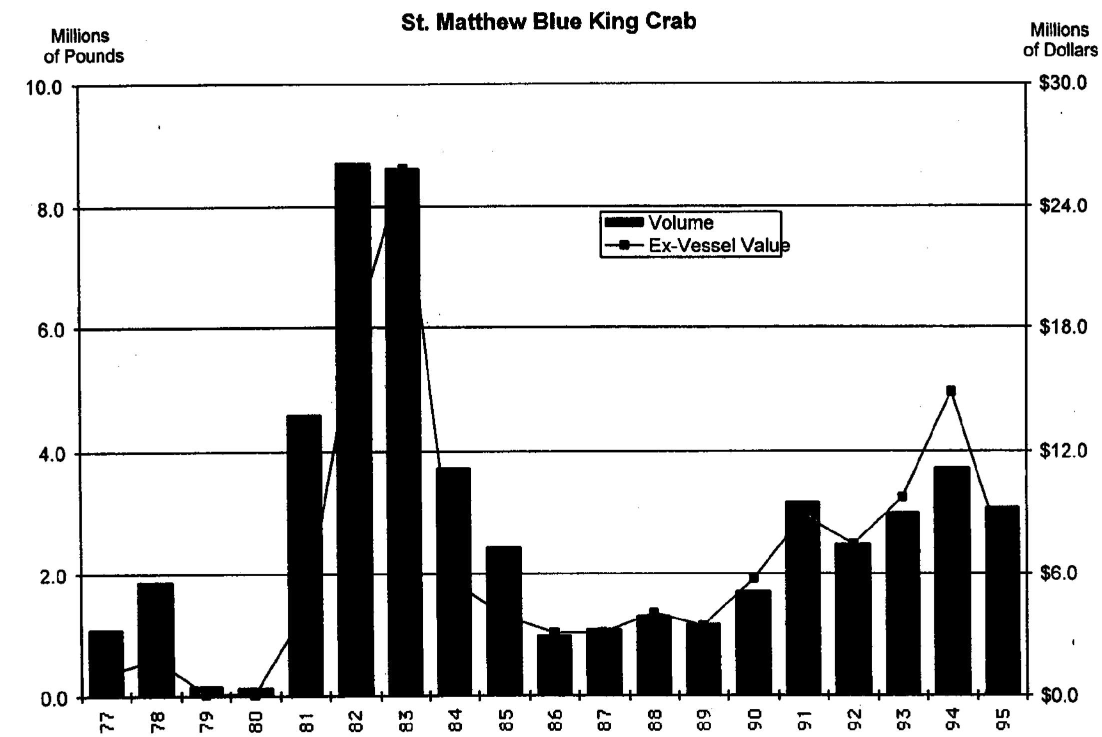
TABLE B-2.8.-- *Effort (number of vessels), total catch, average catch per vessel, ex-vessel price, total ex-vessel value, and average per-vessel value for St. Matthew blue king crab, 1977-95*

Saint Matthew Blue King Crab (Area "Q" not including St. Lawrence Islands catch)

Year	Number Vessels	Total Catch (1) (lbs)	Average Per Vessel Catch (lbs/vessel)	Ex-Vessel Price ($/lb)	Total Annual Ex-vessel Value ($)	Average Per Vessel Value ($/vessel)
1977	10	1,072,918	107,292	$1.00	$1,072,918	$107,292
1978	22	1,868,214	84,919	$0.95	$1,774,803	$80,673
1979	18	154,672	8,593	$0.70	$108,270	$6,015
1980	2	144,777	72,389	$0.75	$108,583	$54,291
1981	31	4,574,406	147,561	$0.90	$4,116,965	$132,805
1982	96	8,701,816	90,644	$2.00	$17,403,632	$181,288
1983	164	8,625,329	52,593	$3.00	$25,875,987	$157,780
1984	90	3,732,609	41,473	$1.50	$5,598,914	$62,210
1985	79	2,424,497	30,690	$1.60	$3,879,195	$49,104
1986	38	970,602	25,542	$3.20	$3,105,926	$81,735
1987	61	1,074,779	17,619	$2.85	$3,063,120	$50,215
1988	46	1,302,827	28,322	$3.10	$4,038,764	$87,799
1989	69	1,162,504	16,848	$2.90	$3,371,262	$48,859
1990	31	1,707,933	55,095	$3.35	$5,721,576	$184,567
1991	68	3,155,607	46,406	$2.80	$8,835,700	$129,937
1992	174	2,474,080	14,219	$3.00	$7,422,240	$42,657
1993	92	2,999,921	32,608	$3.23	$9,689,745	$105,323
1994	87	3,717,563	42,731	$4.00	$14,870,252	$170,922
1995 2/	90	3,075,902	34,177	$2.32	$7,136,093	$79,290

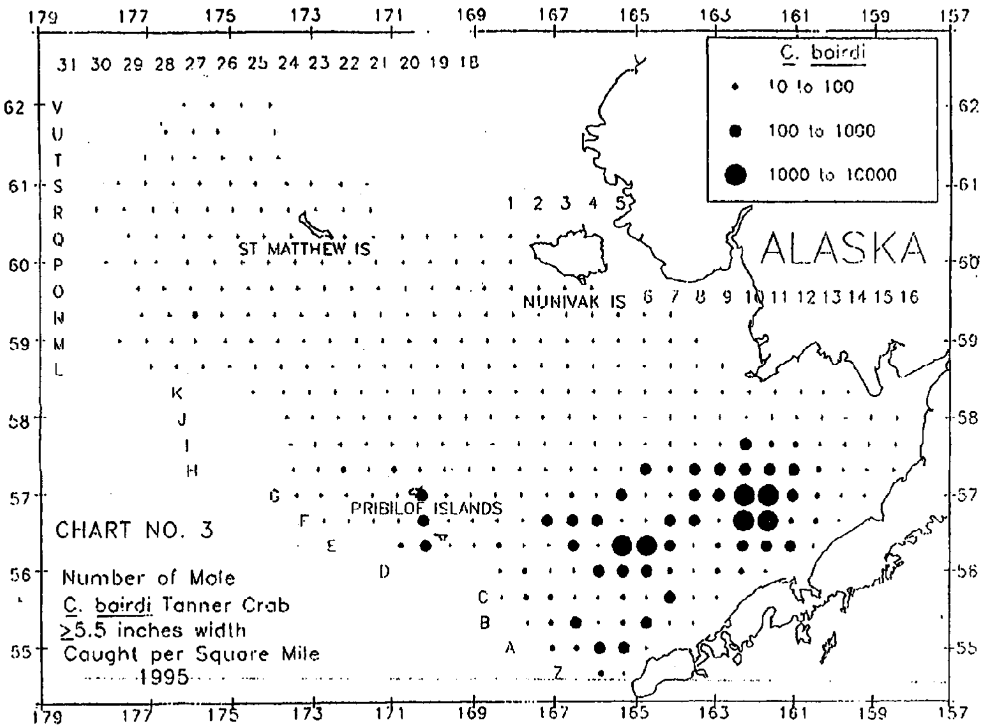
(1) Catch and value figures exclude deadloss.
(2) 1995 catch and price values are preliminary.

Source: ADF&G Westward Region Shellfish Reports.



Source: ADF&G Westward Region Shellfish Reports.

FIGURE B-2.10.--Total catch and ex-vessel value for St. Matthew blue king crab, 1977-95.



Source: NMFS.

FIGURE B-2.11.--Catch per unit effort (numbers per square mile) of male tanner crab (C. bairdi) ≥ *5.5 inches in width in the Eastern Bering Sea, 1995.*

TABLE B-2.9.--*Annual abundance estimates (millions of crabs) for tanner crab (C. bairdi) from NMFS surveys*

	Males				Females			
	Juveniles	Pre-rec	Large		Small	Large		Grand Total
Size[1](mm)	<110	110-134	≥135	Total	<85	≥85	Total	
Width(in)	<4.3	4.3-5.3	≥5.3		<3.4	≥3.4		
1976	180.2	136.6	109.5	426.3	174.7	220.4	395.1	821.4
1977	255.0	116.3	92.1	463.4	328.4	215.8	544.2	1,007.6
1978	124.2	81.2	45.6	251.0	116.1	73.3	189.4	440.4
1979	133.1	47.7	31.5	212.3	122.6	42.1	164.7	377.0
1980	453.3	65.0	31.0	549.3	326.9	106.8	433.7	983.0
1981	303.8	24.0	14.0	341.8	324.2	79.1	403.3	745.1
1982	88.8	46.9	10.1	145.8	126.4	83.6	210.0	355.8
1983	146.3	32.0	6.7	185.0	180.1	45.4	225.5	410.5
1984	85.1	21.2	5.8	112.1	107.0	33.4	140.4	252.5
1985	31.1	9.4	4.4	44.9	24.2	15.6	39.8	84.7
1986	110.4	12.9	3.1	126.4	68.2	13.7	81.9	208.3
1987	230.1	19.7	8.3	258.0	193.3	35.5	228.8	486.8
1988	287.3	59.7	17.4	364.4	184.8	81.0	265.8	630.2
1989	403.0	102.1	42.3	547.5	338.6	63.8	402.4	949.9
1990	286.1	78.8	53.7	418.6	266.5	97.4	363.9	782.5
1991	267.2	105.4	45.5	418.1	232.1	116.8	348.9	767.0
1992	121.0	101.9	52.8	275.7	98.9	63.9	162.8	438.5
1993	76.6	63.4	27.2	167.7	57.6	29.6	87.2	254.9
1994	47.9	38.6	20.0	106.6	57.9	27.5	85.5	192.0
Limits[2]								
Lower	33.1	27.8	13.2	82.1	26.7	15.7	48.7	130.8
Upper	62.8	49.5	26.8	131.1	89.2	39.3	122.2	253.3
±%	31	28	34	23	54	43	43	32

[1] Carapace width (mm).

[2] Mean ± 2 standard errors for most recent year.

Note: Data since 1988 are for Eastern District; all prior data are for Bristol Bay and the Pribilof Districts; both areas contain virtually all legal males.

Source: NMFS.

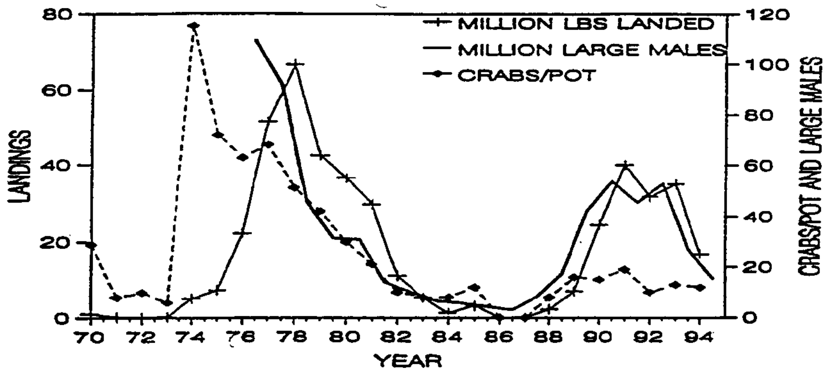
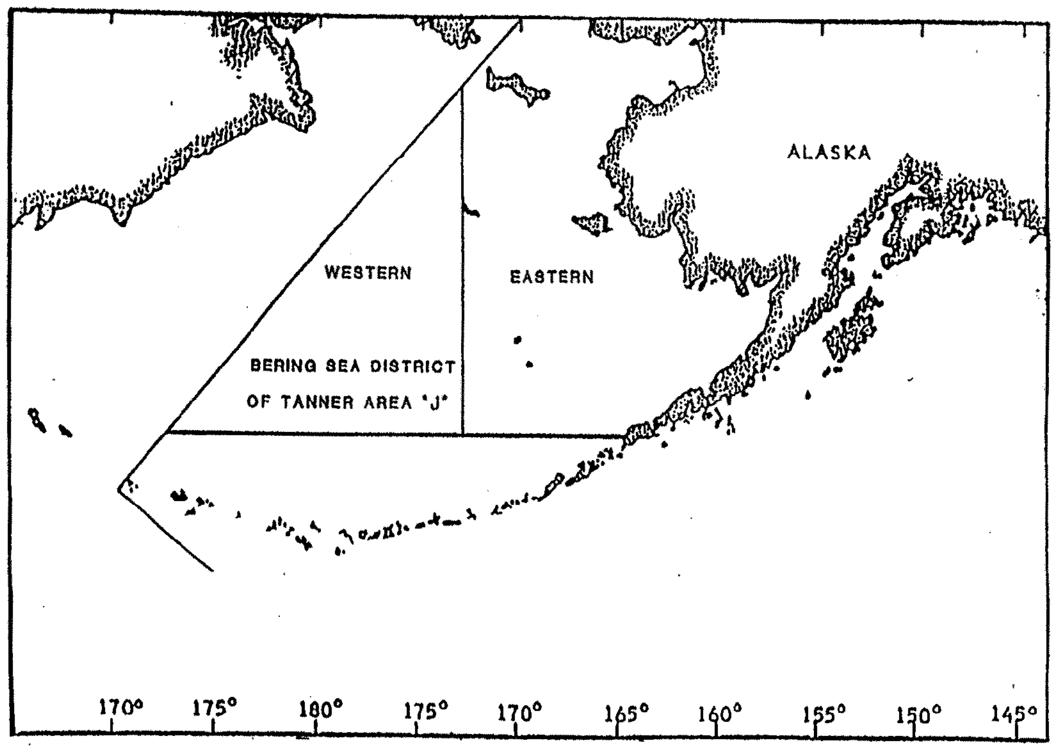


FIGURE B-2.12.--U.S. landings, CPUE as crabs/pot, and abundance of large male tanner crab (C. bairdi) *in millions in Bristol Bay and Pribilof Districts (prior to 1989) or the Eastern District (since 1989), estimated from NMFS trawl surveys.*

Harvest and Value. ADF&G controls the location of the *bairdi* tanner crab fishery and can open either the Eastern or Western Subdistrict of the Bering Sea, or both, depending upon abundance, in-season catch per unit effort, and concern for red king crab bycatch. Only male *bairdi* tanner crab of 5.5 inches and greater carapace width are allowed to be retained. In 1994, the season lasted about 21 days beginning November 1 and was restricted to the Eastern Subdistrict, which includes the Pribilof Islands (figure B-2.13). A similar season length is expected in 1995. The harvest of *bairdi* tanner crab has declined significantly, from nearly 40 million pounds in 1990-91 to an expected 5.5 million pounds in the 1995 fishery (table B-2.10 and figure B-2.14). Only about 500,000 pounds of *bairdi* tanner crab has been landed at St. Paul each season. Most of this catch is processed at sea or landed in Dutch Harbor. As supplies of *bairdi* tanner and other crab have declined, the price has increased, producing a relatively stable total ex-vessel value for the fishery. This value has ranged from nearly $59 million in 1992-93 to $28 million in 1994. However, the 1995 price for *bairdi* tanner crab is expected to be significantly lower ($2.75/lb) than the 1994 price of $3.75/lb due to an increase in supply of lower-priced crab from the Russian Far East on the Asian markets. The average value per vessel in this fishery has declined from nearly $200,000 in 1992-93 to an expected $84,000 in 1995. Little improvement in harvest volume or value is expected in the foreseeable future in this fishery.



Source: ADF&G.

FIGURE B-2.13.--Alaska Department of Fish and Game Bering Sea tanner crab subdistricts.

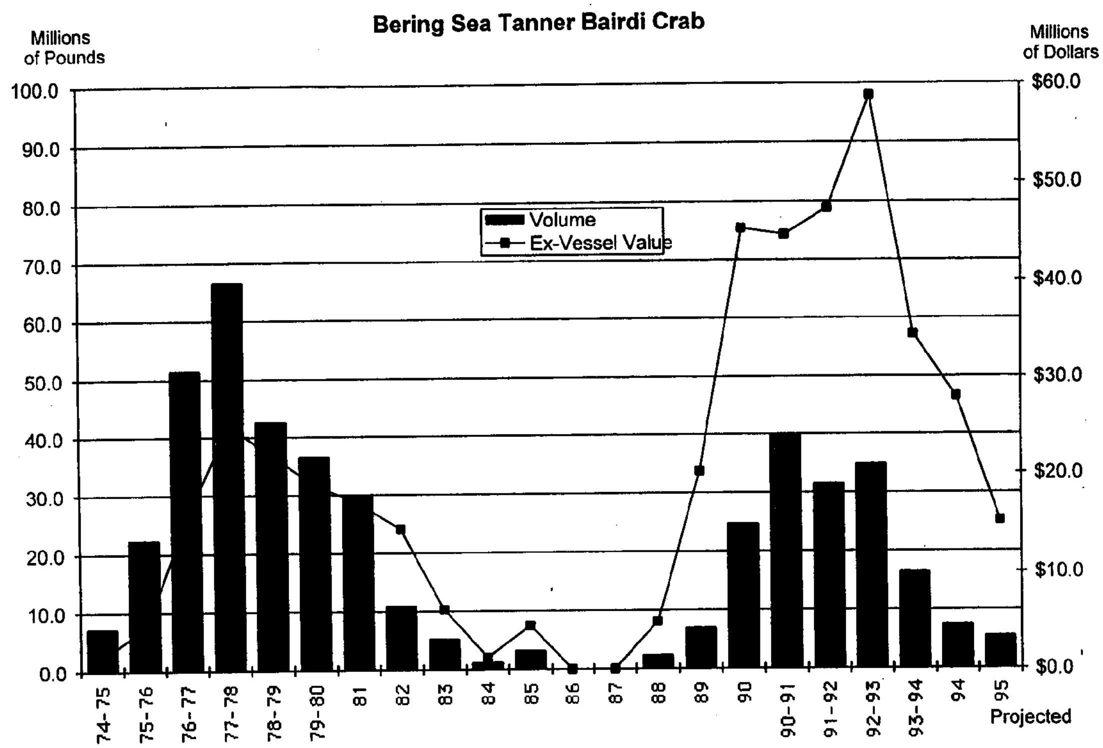
TABLE B-2.10.— *Effort (number of vessels), total catch, average catch per vessel, ex-vessel price, total ex-vessel value, and average per-vessel value for Bering Sea tanner* bairdi *crab, 1974/75-95*

Eastern Bering Sea Tanner Bairdi Crab Year	Number Vessels	Total Catch (1) (lbs)	Average Per Vessel Catch (lbs/vessel)	Ex-Vessel Price ($/lb)	Total Annual Ex-vessel Value ($)	Average Per Vessel Value ($/vessel)
1974-75	28	7,284,378	260,156	$0.20	$1,456,876	$52,031
1975-76	66	22,341,475	338,507	$0.19	$4,244,880	$64,316
1976-77	83	51,455,221	619,942	$0.30	$15,436,566	$185,983
1977-78	120	66,430,855	553,590	$0.38	$25,243,725	$210,364
1978-79	144	42,471,174	294,939	$0.52	$22,085,010	$153,368
1979-80	152	36,557,869	240,512	$0.52	$19,010,092	$125,066
1981	165	29,630,492	179,579	$0.58	$17,185,685	$104,156
1982	125	10,870,620	86,965	$1.33	$14,457,925	$115,663
1983	108	5,213,852	48,276	$1.20	$6,256,622	$57,932
1984	41	1,203,198	29,346	$0.95	$1,143,038	$27,879
1985	44	3,137,402	71,305	$1.40	$4,392,363	$99,826
1986			Commercial Fishery Closed			
1987			Commercial Fishery Closed			
1988	98	2,199,670	22,446	$2.17	$4,773,284	$48,707
1989	109	6,978,301	64,021	$2.90	$20,237,073	$185,661
1990	179	24,461,824	136,658	$1.85	$45,254,374	$252,818
1990-91	255	39,870,786	156,356	$1.12	$44,655,280	$175,119
1991-92	285	31,516,640	110,585	$1.50	$47,274,960	$165,877
1992-93	294	34,786,911	118,323	$1.69	$58,789,880	$199,966
1993-94	296	16,632,931	56,192	$2.06	$34,263,838	$115,756
1994	180	7,443,873	41,355	$3.75	$27,914,524	$155,081
1995	180	5,500,000	30,556	$2.75	$15,125,000	$84,028

(1) Catch and value figures exclude deadloss.

(2) 1995 catch and value are projected.

Source: ADF&G Westward Region Shellfish Reports.



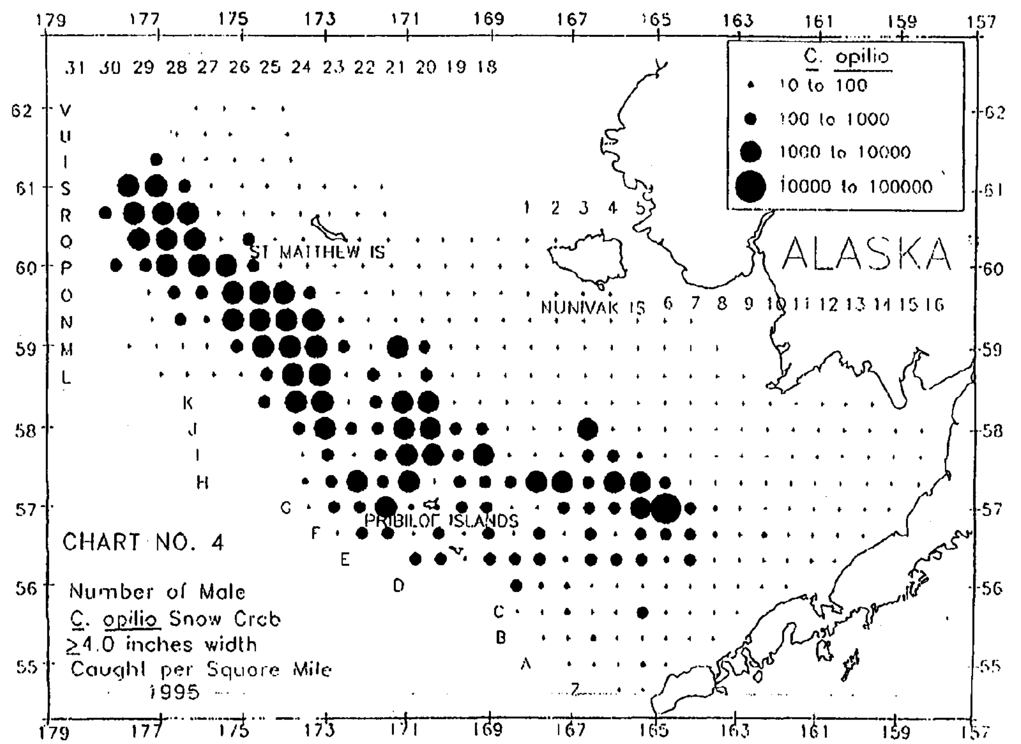
Source: ADF&G Westward Region Shellfish Reports.

FIGURE B-2.14.--Total catch and ex-vessel value for Bering Sea tanner bairdi *crab, 1974/75-95.*

2.3.5* Opilio *Tanner Crab.

Distribution and Abundance. *Opilio* tanner crab are distributed primarily along the outer edge of the continental shelf, from just south and east of the Pribilof Islands to north and west of the U.S./Russian Convention line and beyond (figure B-2.15). *Opilio* tanner crab are the most abundant commercial crab species in the Eastern Bering Sea. Overall abundance of this species has varied from nearly 1 billion in 1985 to nearly 12 billion in 1993 (table B-2.11). Large and very large *opilio* tanner crab, which support the commercial fishery, declined from their peak abundance in 1991 to relatively low levels in 1994 (figure B-2.16). Based on the abundance of juvenile and pre-recruit males, the prognosis for this stock is for significantly increased abundance in commercial-sized crab over the next 2 to 5 years.

Harvest and Value. ADF&G controls the location of the *opilio* tanner crab fishery between the two tanner crab subdistricts in the Eastern Bering Sea (figure B-2.13). Weather and sea-ice conditions can also influence the harvest patterns of *opilio* tanner crab in these areas. Although no size or sex limits are placed on *opilio* tanner crab, the processors require fishermen to land crab with a 4.0-inch and greater carapace shell width, which generally excludes all but the larger male crab. In the 1990-91 season, the fishery lasted from January 15 through June 23. Season lengths have declined as the guideline harvest quotas have declined, with recent seasons lasting from January 15 through March 1. Harvests have declined significantly over the past 5 years as the abundance of large male crab has declined. The peak harvest occurred in 1991, with more than 325 million pounds landed (table B-2.12 and figure B-2.17). In 1994, about 148 million pounds were landed; of this, 21.6 million pounds (15 percent) was landed at St. Paul for processing. The 1995 harvest was estimated to be nearly 74 million pounds, with St. Paul processing about the same percentage of the harvest. The harvest value of *opilio* tanner crab has remained fairly constant, between $170 million and $190 million annually, over the past 3 years. The price of *opilio* tanner crab has been influenced less by Russian product, since very little *opilio* tanner crab is presently harvested in the Russian Far East. Russian companies choose to concentrate on higher-valued species and species distributed closer to their regional operational centers in the Sea of Okhotsk. The average per-vessel value of the *opilio* tanner crab fishery in the Eastern Bering Sea has been about $700,000 per year over the past 3 years. Based on abundance estimates of pre-recruit *opilio* tanner crab, ADF&G and the NMFS project substantial increases in large male crab abundance and harvests in the 1997-98 season. NRC predicts that the 1996 harvest in the Eastern Bering Sea will be approximately equal to the 1995 season, at about 75 million pounds. The 1997 season should produce a harvest of about 150 million pounds, followed by up to 300 million pounds in 1998. Projections of harvest beyond 1998 are difficult, but are likely to be in the 150-million to 225-million-pound range.



Source: NMFS.

FIGURE B-2.15.--Catch per unit effort (numbers per square mile) of male snow crab (C. opilio) ≥ *4.0 inches in width in the Eastern Bering Sea, 1995.*

TABLE B-2.11.--*Annual abundance estimates (millions of crabs) for Eastern Bering Sea snow crab* (C. opilio) *from NMFS surveys (all districts combined)*

	Males				Females			
		Large	V. Large		Small	Large		Grand
Size[1](mm)	<102	≥102	≥110	Total	<50	≥50	Total	Total
Width(in)	<4.0	≥4.0	≥4.3		<2.0	≥2.0		
1982	*	*	21.7	2073	403	2256	2658	4732
1983	*	*	22.1	1858	673	1228	1913	3760
1984	1237	153	73.9	1391	610	582	1192	2583
1985	548	75	40.7	623	258	123	382	1004
1986	1179	83	45.9	1262	791	422	1212	2474
1987	4439	151	70.0	4590	2919	2929	5849	10438
1988	3467	171	90.1	3638	1235	2323	3556	7194
1989	3646	187	81.2	3833	1923	3791	5713	9546
1990	2860	420	188.7	3281	1463	2798	4261	7542
1991	3971	484	323.0	4455	3289	3575	6864	11319
1992	3158	256	164.8	3414	2434	1914	4348	7763
1993	5597	135	77.9	5732	3990	1983	5972	11704
1994	4283	72	39.9	4354	3418	1674	5092	9446
East(%)[2]	54	45	41	53	27	77	44	48
<u>Limits</u>[3]								
Lower	2998	54	30	3048	1982	1088	3463	6510
Upper	5567	89	50	5660	4853	2260	6721	12382
±%	30	24	25	30	42	35	32	31

[1] Carapace width (mm).
[2] Proportion of size group in Eastern District.
[3] Mean ± 2 standard errors for most recent year.
* Estimates not available at present time.

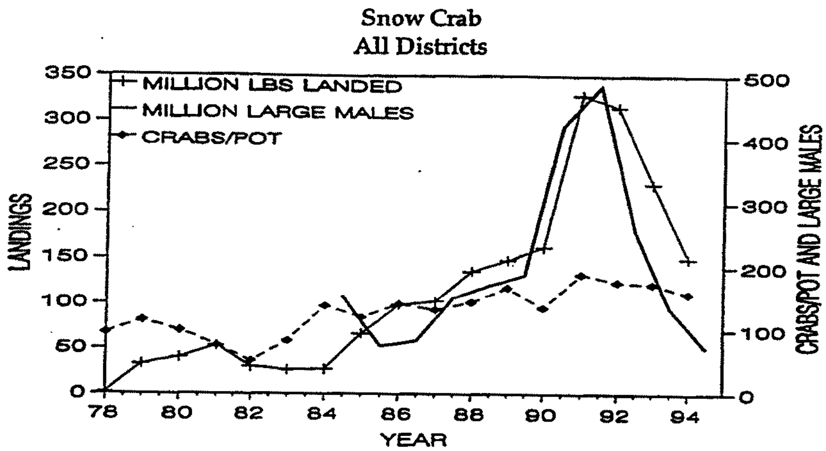


FIGURE B-2.16.--U.S. landings, CPUE as crabs/pot, and abundance of large male snow crab (C. opilio) *in millions (all districts combined), estimated from NMFS trawl surveys.*

2.3.6 Korean Horsehair Crab.

Distribution and Abundance. Korean horsehair crab (hair crab) are distributed mainly near the Pribilof Islands in the central Eastern Bering Sea (figure B-2.18). ADF&G manages hair crab as a single stock throughout the entire Eastern Bering Sea. The overall abundance of hair crab has varied significantly from year to year, with recent abundance ranging from 15 million crab in 1990 to a low of about 4.2 million in 1992 (table B-2.13). The 1994 NMFS survey found an overall abundance of 9.5 million hair crab, of which 3.6 million were large males (figure B-2.19). Based on the abundance of male pre-recruit hair crab found during the past three years, the outlook for hair crab is promising. The trend in hair crab abundance in the Eastern Bering Sea, and particularly around the Pribilof Islands, is stable or slightly increasing over the foreseeable future.

Harvest and Value. The hair crab fishery is controlled by ADF&G in the Eastern Bering Sea. Male crab 3.25 inches and greater are allowed to be retained. The fishery is centered on the Pribilof Islands. The start date and length of the season have varied significantly depending upon the number of vessels participating. In recent years, the fishery has begun on November 1 and lasted through mid-December, with about 10 vessels participating. Nearly all of the hair crab harvested are landed in the Pribilof Islands, with about 50 percent landed at St. Paul. Recent harvests have been between 1.5 million and 2.0 million pounds (table B-2.14) with an ex-vessel value of about $2.5 million to $5.0 million (figure B-2.20). The average ex-vessel value in the

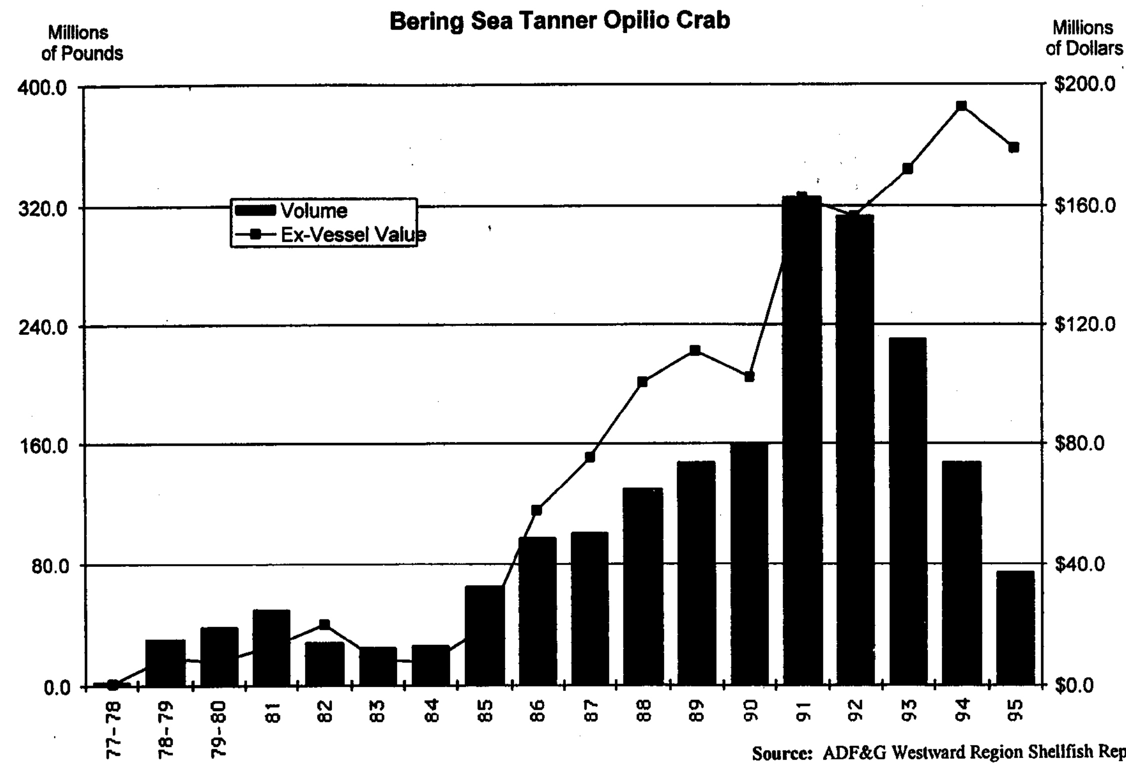
TABLE B-2.12.-- *Effort (number of vessels), total catch, average catch per vessel, ex-vessel price, total ex-vessel value, and average per-vessel value for Bering Sea tanner* opilio *crab, 1977/78-95*

Eastern Bering Sea Tanner Opilio Crab

Year	Number Vessels	Total Catch (1) (lbs)	Average Per Vessel Catch (lbs/vessel)	Ex-Vessel Price ($/lb)	Total Annual Ex-vessel Value ($)	Average Per Vessel Value ($/vessel)
1977-78	15	1,716,124	114,408	$0.38	$652,127	$43,475
1978-79	102	31,427,866	308,116	$0.30	$9,428,360	$92,435
1979-80	134	39,344,323	293,614	$0.21	$8,262,308	$61,659
1981	153	50,480,055	329,935	$0.26	$13,124,814	$85,783
1982	122	28,312,724	232,072	$0.73	$20,668,289	$169,412
1983	109	24,803,944	227,559	$0.35	$8,681,380	$79,646
1984	52	26,014,330	500,276	$0.30	$7,804,299	$150,083
1985	75	64,934,691	865,796	$0.30	$19,480,407	$259,739
1986	88	96,591,606	1,097,632	$0.60	$57,954,964	$658,579
1987	103	100,924,939	979,854	$0.75	$75,693,704	$734,890
1988	171	130,800,165	764,913	$0.77	$100,716,127	$588,983
1989	168	147,611,166	878,638	$0.75	$110,708,375	$658,978
1990	189	160,024,686	846,691	$0.64	$102,415,799	$541,883
1991	220	325,183,233	1,478,106	$0.50	$162,591,617	$739,053
1992	250	312,976,182	1,251,905	$0.50	$156,488,091	$625,952
1993	254	229,213,048	902,414	$0.75	$171,909,786	$676,810
1994	273	147,976,442	542,038	$1.30	$192,369,375	$704,650
1995	255	73,965,508	290,061	$2.42	$178,996,529	$701,947

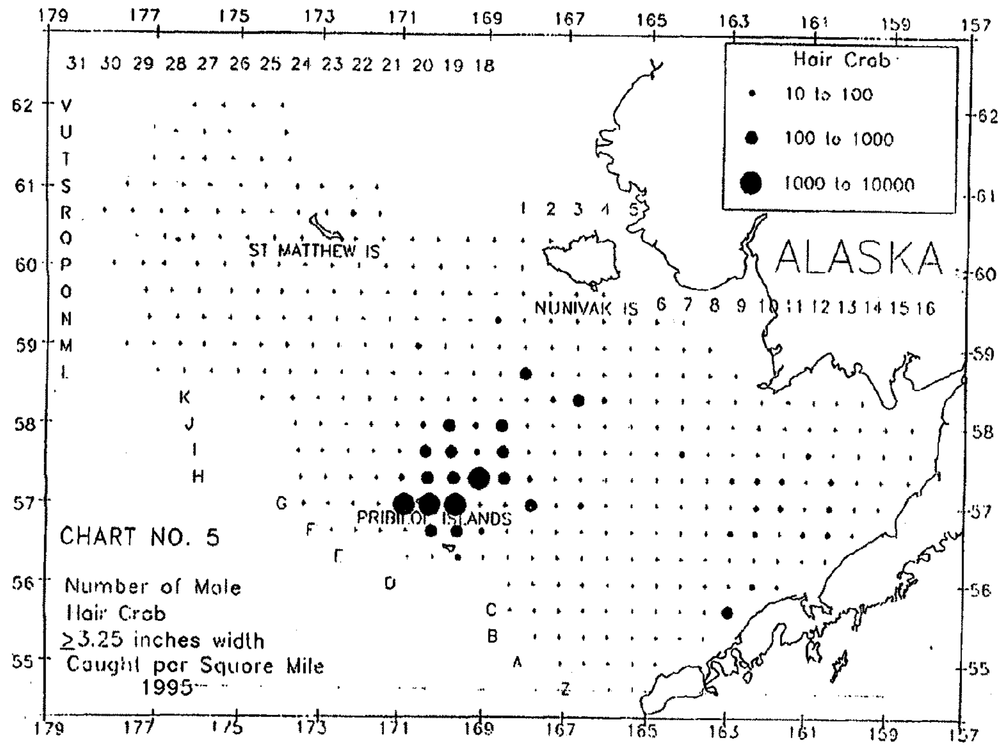
(1) Catch and value figures exclude deadloss.
(2) 1995 catch and value figures are preliminary.

Source: ADF&G Westward Region Shellfish Reports.



Source: ADF&G Westward Region Shellfish Reports.

FIGURE B-2.17.--Total catch and ex-vessel value for Bering Sea tanner opilio *crab, 1977/78-95.*



Source: NMFS.

FIGURE B-2.18.--Catch per unit effort (numbers per square mile) of male hair crab (E. isenbecki) ≥ *3.25 inches in width in the Eastern Bering Sea, 1995.*

TABLE B-2.13.--*Annual abundance estimates (millions of crabs) for hair crab* (E. isenbecki) *from NMFS surveys*

	Males			Females	
	Small	Large			
Size[1] (mm)	<83	≥83	Total	Total	Grand Total
Width (in)	<3.25	≥3.25			
1980	2.02	14.86	16.88	2.62	19.51
1981	2.84	14.33	17.16	0.87	18.03
1982	0.54	8.07	8.61	0.42	9.03
1983	0.24	4.39	4.63	0.83	5.46
1984	0.73	3.32	4.06	0.51	4.56
1985	0.30	2.56	2.86	0.26	3.12
1986	0.68	1.82	2.49	0.38	2.87
1987	1.59	1.35	2.93	0.89	3.83
1988	3.01	0.87	3.88	0.86	4.74
1989	11.38	1.46	12.84	0.67	13.51
1990	12.99	1.09	14.08	0.92	15.00
1991	4.45	1.27	5.72	1.18	6.90
1992	2.49	1.17	3.65	0.55	4.20
1993	9.14	2.64	11.77	1.50	13.28
1994	4.65	3.56	8.21	1.26	9.46
Limits[2]					
Lower	2.00	1.78	4.60	0.14	4.73
Upper	7.31	5.33	11.82	2.37	14.19
±%	57	50	44	89	50

[1] Carapace length (mm).
[2] Mean ± 2 standard errors for most recent year.

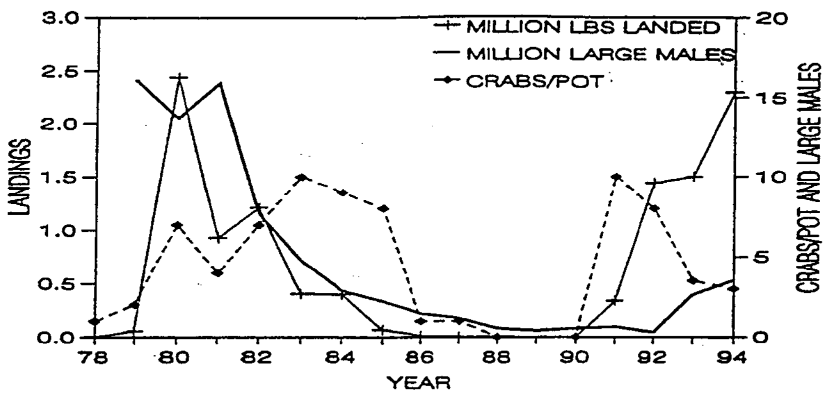


FIGURE B-2.19.--U.S. landings, CPUE as crabs/pot, and abundance of large male hair crab (E. isenbecki) *in millions (all districts combined), estimated from NMFS trawl surveys.*

hair crab fishery is about $150,000 to $270,000 per vessel. NRC believes that for the foreseeable future this fishery is likely to continue at the harvest volume and value level experienced over the past 2 years.

2.3.7 Russian **Opilio** *Tanner Crab.*

Distribution and Abundance. Little official information is available about the distribution of *opilio* tanner crab in the Russian zone of the Western Bering Sea. The U.S. and Russia have conducted joint stock assessment surveys in recent years beyond the U.S./Russian Convention line northwest of the Pribilof Islands, and concentrations of *opilio* tanner crab similar to those in the adjacent U.S. waters have been found. Russian scientists with TINRO believe that the *opilio* tanner crab abundance in the Western Bering Sea equals or exceeds that found in U.S. waters. The main area of concentration of *opilio* tanner crab is found just across the convention line in the Western Bering Sea (figure B-2.21).

Harvest and Value. There is currently no Russian or other tanner crab fishery in the Western Bering Sea. TINRO has allocated a very conservative annual harvest quota of 3.86 million pounds per year. Due to the remoteness of the area, the lack of shore-based support infrastructure, and little interest by Russia or other countries, this quota allocation has gone unused and is likely to go unused for the foreseeable future (5 to 7 years). St. Paul Harbor offers the only feasible shore-based processing facility for *opilio* tanner crab from the Russian zone due to its relatively

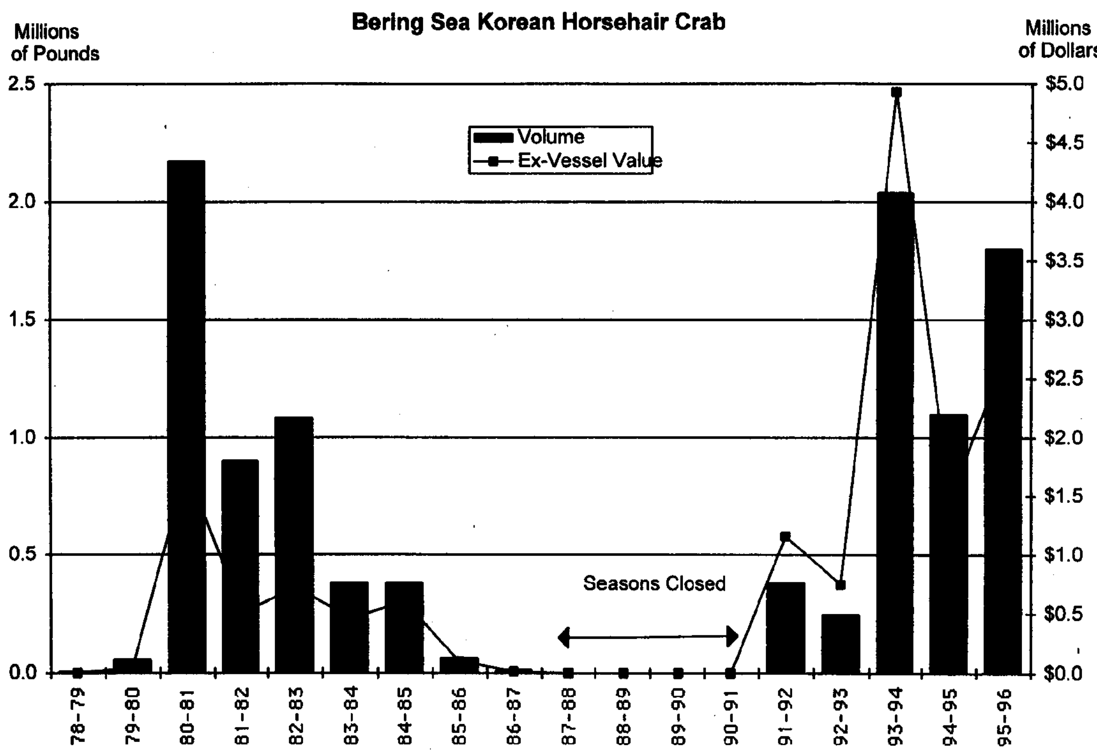
TABLE B-2.14.--*Effort (number of vessels), total catch, average catch per vessel, ex-vessel price, total ex-vessel value, and average per-vessel value for Bering Sea Korean horsehair crab, 1978/79-95 (projected)*

Bering Sea Korean Horsehair Crab

Year	Number Vessels	Total Catch (1) (lbs)	Average Per Vessel Catch (lbs/vessel)	Ex-Vessel Price ($/lb)	Total Annual Ex-vessel Value ($)	Average Per Vessel Value ($/vessel)
1978-79	11	5,213	474	$0.53	$2,763	$251
1979-80	9	53,914	5,990	$0.75	$40,436	$4,493
1980-81	67	2,174,114	32,449	$0.80	$1,739,291	$25,960
1981-82	48	902,835	18,809	$0.55	$496,559	$10,345
1982-83	52	1,088,964	20,942	$0.65	$707,827	$13,612
1983-84	19	378,476	19,920	$1.20	$454,171	$23,904
1984 -85	7	377,194	53,885	$1.60	$603,510	$86,216
1985-86	3	65,449	21,816	$1.60	$104,718	$34,906
1986-87	3	14,335	4,778	$1.15	$16,485	$5,495
1987-88	2	1,399	700	$3.00	$4,197	$2,099
1988-89			Commercial Fishery Closed			
1989-90			Commercial Fishery Closed			
1990-91			Commercial Fishery Closed			
1991-92	7	377,708	53,958	$3.08	$1,163,341	$166,192
1992-93	9	240,767	26,752	$3.08	$741,562	$82,396
1993-94	19	2,035,302	107,121	$2.42	$4,925,431	$259,233
1994-95	10	1,100,696	110,070	$1.34	$1,474,933	$147,493
1995-96 (1)	10	1,800,000	180,000	$1.50	$2,700,000	$270,000

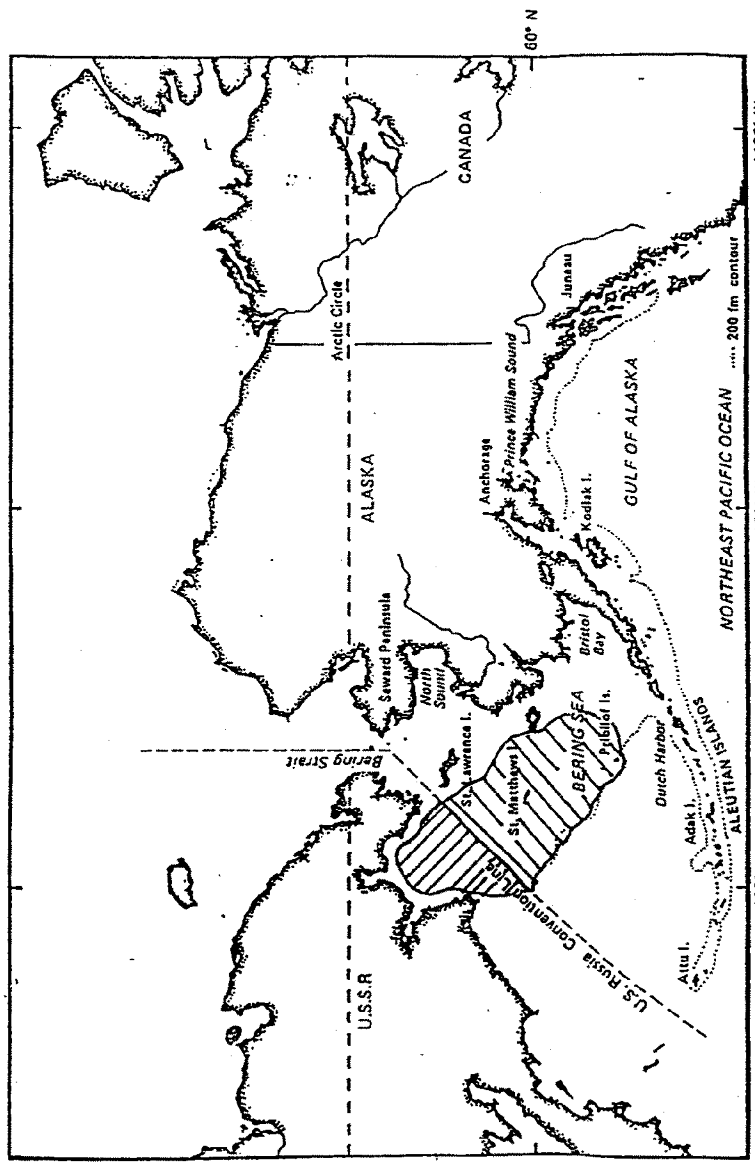
(1) Catch and value figures excludes deadloss.
(2) 1995 Catch and value are projected.

Source: ADF&G Westward Region Shellfish Reports.



Source: ADF&G Westward Region Shellfish Reports.

FIGURE B-2.20.--Total catch and ex-vessel value for Bering Sea Korean horsehair crab, 1978/79-95 (projected).



Source: TINRO.

FIGURE B-2.21.--Distribution of Tanner crab (C. opilio) in the Russian zone of the Western Bering Sea.

short distance from the fishing grounds. Dutch Harbor is too distant, and the run would result in significant added deadloss and prohibitive loss due to running time and fuel consumption. St. Paul also offers the only feasible support base for catcher vessels that would operate in the Russian zone of the Western Bering Sea. NRC was told by a U.S. company (who wished its name to remain confidential) that it has available a minimum of 50 percent of the allowable harvest quota of Russian *opilio* tanner crab from the Western Bering Sea, or approximately 1.93 million pounds annually. If an improved St. Paul harbor were available for offloading Russian product and support of catcher vessels, this volume of Russian crab could be caught and processed by U.S. vessels under a quota fee arrangement. Once a successful operation can be demonstrated to the Russian government, the company believes a substantial amount of the 3.86 million pounds of Russian *opilio* tanner crab could be landed and processed at St. Paul. This crab processed at St. Paul would have an identical value to that harvested in U.S. waters. NRC estimates the eventual ex-vessel value of the Russian *opilio* crab at current ex-vessel prices of between $4.7 million and $9.3 million (not including quota fee deduction), depending on the percentage of the available quota. The wholesale value of this crab at the current price of $6.00/lb, FOB Alaska, would range from $5.3 million to $10.6 million.

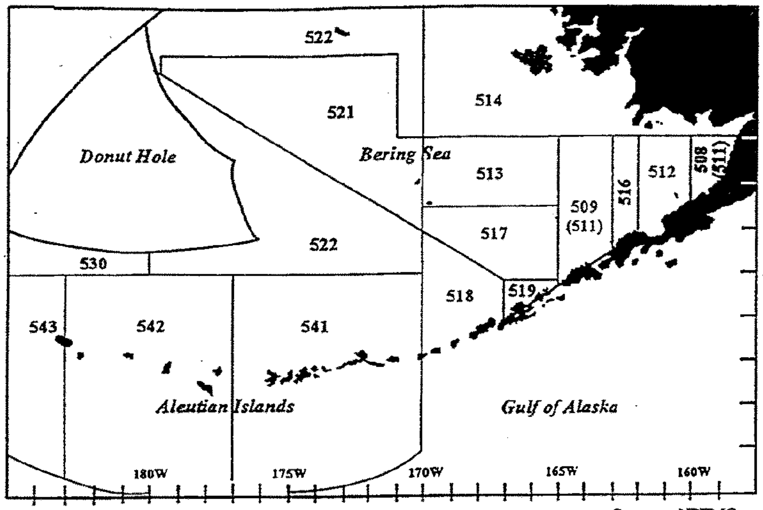
2.4 Groundfish Resources

2.4.1 Introduction.

The term groundfish collectively describes a variety of finfish species caught in Alaska waters. Other terms used to describe these resources include bottomfish, whitefish, and demersal fish. These terms refer to several stocks of midwater- to bottom-dwelling finfish, harvested off the Alaskan coast by large commercial fishing fleets. Groundfish species of major commercial importance in Alaska include Alaska pollock, Pacific cod, Pacific halibut, yellowfin sole, rock sole, other flounders, turbots, sablefish, Atka mackerel, Pacific ocean perch, and a number of other species of rockfish. Of these species, of primary importance in the study area are Alaska pollock, Pacific cod, yellowfin sole, rock sole, other flounders, and Pacific halibut.

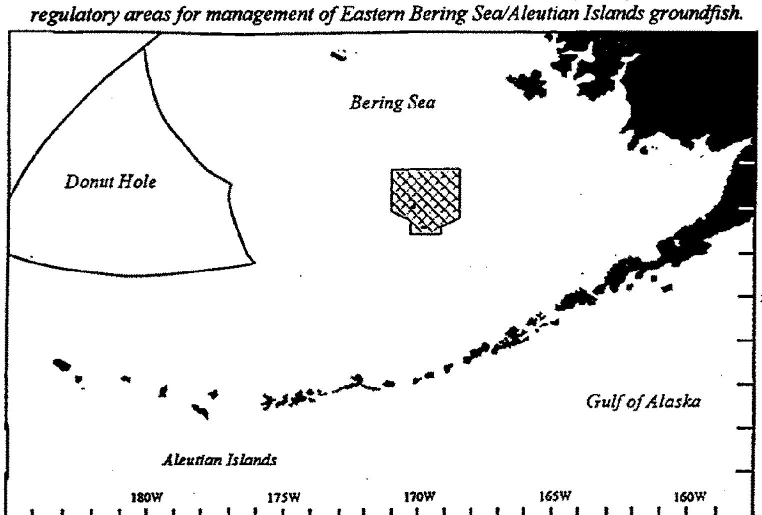
2.4.2 Description of Area.

The groundfish resources in the Eastern Bering Sea are managed by the NMFS and IPHC as part of the Eastern Bering Sea/Aleutian Islands Area. This area is defined as those waters lying south of the Bering Straits, east of the U.S./Russian convention line, and extending south of the Aleutian Islands for 200 nautical miles between the convention line and longitude 170° W. The area is divided into 16 subareas for statistical reporting and small-scale management measures (figure B-2.22). In 1995, a separate area around the Pribilof Islands was dedicated as the Pribilof Islands Habitat Conservation Area. All trawling in this area is prohibited to protect blue king crab, marine mammals, sea birds, and their prey (figure B-2.23).



Source: NPFMC.

FIGURE B-2.22.—National Marine Fisheries Service statistical reporting and regulatory areas for management of Eastern Bering Sea/Aleutian Islands groundfish.



Source: NPFMC.

FIGURE B-2.23.—Location of the Pribilof Islands Conservation Area, closed to all trawling.

The most prominent feature of the Bering Sea is the extensive continental shelf adjacent to North America. This area constitutes approximately 80 percent of the total shelf area in the Bering Sea, with the remaining 20 percent lying in the Russian zone. Roughly 44 percent of the Bering Sea is continental shelf, 13 percent continental slope, and 43 percent is deep-water basin. The continental shelf and slope edge are the most productive areas in terms of groundfish and crab production, but depend upon the upwelling of nutrient-rich waters from the deep-water basin to maintain this production. The Pribilof Islands are situated along the western edge of the Bering Sea's vast continental shelf in the middle of one of the richest marine environments in the world.

2.4.3 Allocation of Resources.

Groundfish resources in the Eastern Bering Sea/Aleutian Islands (EBS/AI) are allocated by the NMFS based on accepted recommendations of the NPFMC. Each year the NMFS conducts trawl, hydroacoustic, long-line, pot, and other stock assessment surveys in the region and collects biological information important in modeling the population dynamics of each species and the groundfish complex as a whole. NMFS operates a commercial fishery harvest reporting system and observer program to determine the quantity of harvest by species, time, area, and gear type during the season. NMFS stock assessment models use research data and commercial harvest data to monitor stock abundance in terms of biomass (weight) and population (numbers) of groundfish by species. Based on the standing stock abundance, recruitment, and growth of a particular species, the NMFS estimates the maximum sustainable yield (MSY) for each species. The MSY is the maximum level of harvest that can be attained without depleting the species. The NMFS then estimates the level of harvest that would constitute overfishing of the stock (OFL). At this level of harvest, long-term damage to the stock's ability to recover would occur. The NMFS also calculates an acceptable biological catch (ABC), which incorporates an ecosystem approach to fishery management, taking into account predator-prey interactions and competition among species. Finally, the NMFS applies an exploitation rate, or percentage of the exploitable biomass that can safely be taken by the commercial fishery for a given species in the coming year, which is the total allowable catch (TAC). These stock assessments and harvest recommendations are presented to the NPFMC, which evaluates them in biological and economic terms and makes recommendations for TAC's, by species, to the U.S. Department of Commerce. The department either approves them or sends them back for further review.

As part of the Magnuson Act, a total annual groundfish harvest cap of 2.0 million metric tons (mt) was placed on harvests from the EBS/AI. Allocations of harvest quotas among individual species must collectively total no more than the 2.0-million-mt cap. Further allocations of species are made by the NPFMC as bycatch in other target species fisheries. The NPFMC also allocates the resources between user groups, such as between shore-based and at-sea operators and between trawl, long-line, and pot gear groups. For example, under current policy, shore-based processing operations are allocated 35 percent of the EBS/AI pollock TAC, while at-sea operators are given 65 percent. This is after 7.5 percent of the overall pollock TAC is allocated to the Community Development Quota (CDQ), to help Native Alaskan communities develop their fishing industries. Overall stock abundance and harvests have remained at a very constant level of production for 20 years, although some stocks have fluctuated up and down due to natural variations in production. The management process for groundfish fisheries off Alaska is by nature conservative in its allocation process, tending to preserve fish stock abundance as outlined in the Magnuson Act. Although complicated and controversial, the management of groundfish stocks off Alaska is one of the most successful fishery management programs in the world.

2.4.4 Total Groundfish.

Distribution and Abundance. Groundfish species are widely distributed throughout the EBS/AI. Generally, groundfish stocks are more abundant on the outer one-third edge of the continental shelf, where nutrient-rich water from the deep basin upwells to produce phytoplankton and zooplankton blooms that are the basis for most marine production. The biomass of the groundfish complex in the EBS/AI has been increasing since 1990, when it was about 14 million mt, to the current estimate of about 20 million mt (table B-2.15 and figure B-2.24). The Eastern Bering Sea accounts for about 90 percent of the biomass and the Aleutian Islands about 10 percent. Due to the overall good health of the groundfish resource, the total ABC (acceptable biological catch) for all species in the group has remained above the 2.0-million-mt cap since 1982, indicating that the resource could sustain additional harvest beyond that allowed by law. The outlook for the biomass of the EBS/AI groundfish complex remains good, with a stable or increasing trend in abundance.

Harvest and Value. The TAC for all groundfish species combined in the EBS/AI has been set at the 2.0-million-mt cap since 1984. Total actual groundfish harvests from the EBS/AI have ranged from 1.7 million mt to nearly 2.0 million mt over the past 5 years (table B-2.15) with a total annual ex-vessel value of between $650 million and $700 million. Approximately 75 percent of the volume and value of groundfish harvested in the EBS/AI occurs in the vicinity of St. Paul Island. Harvests have fallen just short of the total TAC due to seasonal bycatch-caused closures and the desire by NMFS to keep the harvest within the TAC for each species. The overall exploitation rate of groundfish in the EBS/AI has ranged from 10 percent to 12 percent of exploitable biomass, which is a very conservative harvest strategy. Since 1990, all groundfish harvested in the EBS/AI are caught by domestic operators and processed by U.S.-based at-sea or shore-based processors (table B-2.16 and figure B-2.25).

In recent years, the majority (64 percent) of the groundfish harvest in the EBS/AI has been taken by the at-sea catcher/processor fleet, including both trawlers and long-liners. Shore-based catcher vessels harvest about 28 percent of the total EBS/AI

TABLE B-2.15.--*Biomass, acceptable biological catch, total allowable catch, and actual catch in metric tons for all groundfish species in the Bering Sea/Aleutian Islands, 1977-95*

Year	BIOMASS (1)	OY/ABC (2)	TAC	CATCH
1977	11,124,439	1,367,500	1,346,500	1,235,492
1978	11,124,439	1,486,370	1,467,700	1,363,601
1979	11,136,439	1,485,570	1,466,900	1,234,742
1980	11,330,239	1,571,226	1,571,226	1,330,474
1981	14,125,125	1,579,226	1,579,226	1,363,816
1982	16,380,115	2,000,000	1,579,226	1,319,812
1983	18,099,941	2,100,000	1,623,591	1,379,594
1984	16,496,000	2,248,345	2,000,000	1,618,926
1985	17,429,625	2,149,330	2,000,000	1,741,337
1986	17,443,024	2,199,000	2,000,000	1,723,627
1987	17,010,676	2,245,780	2,000,000	1,663,376
1988	18,105,000	2,863,100	2,000,000	1,980,147
1989	14,030,700	2,700,700	2,000,000	1,726,289
1990	13,826,900	3,074,500	2,000,000	1,724,730
1991	14,700,205	2,932,485	2,000,000	1,765,397
1992	16,102,100	2,773,355	2,000,000	1,996,467
1993	15,956,900	2,476,245	2,000,000	1,755,145
1994	17,252,900	2,656,435	2,000,000	1,943,793
1995	19,643,500	2,836,985	2,000,000	

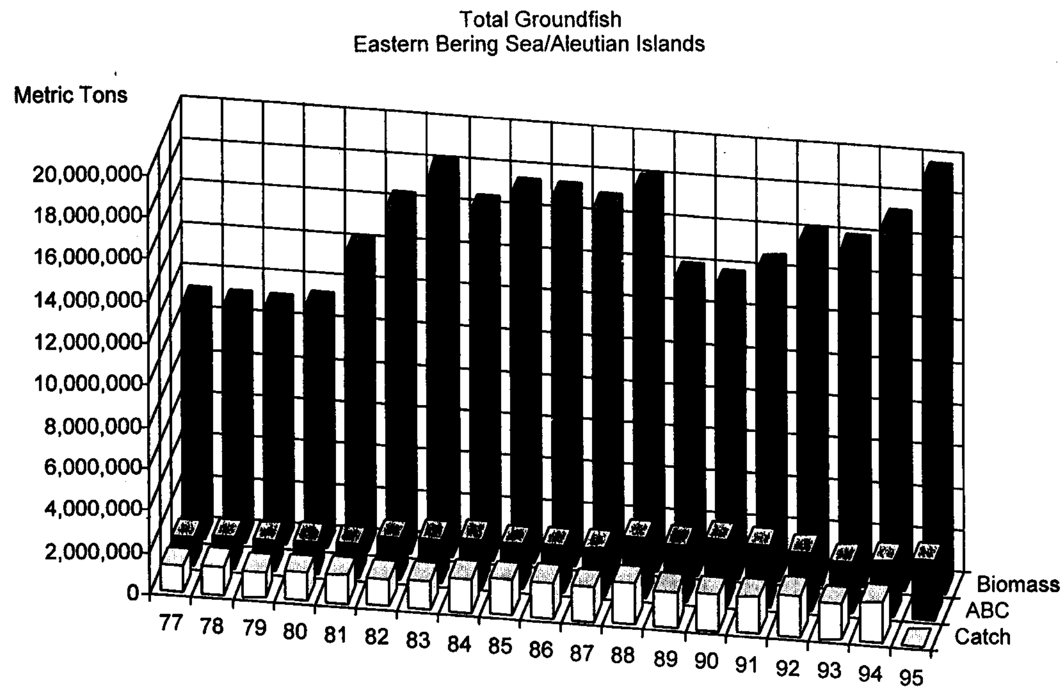
Note 1: Biomass are as reported in RAD documents or totaled from individual species. Where biomass estimates were not available for a given year, the value from the nearest preceding year was used.

Note 2: OYs (optimum yield) were used in Eastern Bering Sea/Aleutian Island groundfish allocations from 1977 to 1981 and are essentially equivalent to ABCs since 1982.

Source: NMFS.

groundfish harvest, and mothership/catcher vessel operations have taken about 8 percent of the total groundfish catch. Shore-based operations concentrate mainly on pollock, Pacific cod, halibut, and sablefish. Pollock is the primary mothership-based catcher boat fishery, with some Pacific cod and other species also landed. At-sea catcher/processors target nearly all of the species of the EBS/AI groundfish complex.

By gear category, trawl fisheries dominate the EBS/AI groundfish harvest, taking about 94 percent of the total catch, followed by long-liners with less than 6 percent.



Source: NMFS.

FIGURE B-2.24.--Biomass, acceptable biological catch (ABC), and actual catch of all groundfish in the Eastern Bering Sea/Aleutian Islands, 1977-95.

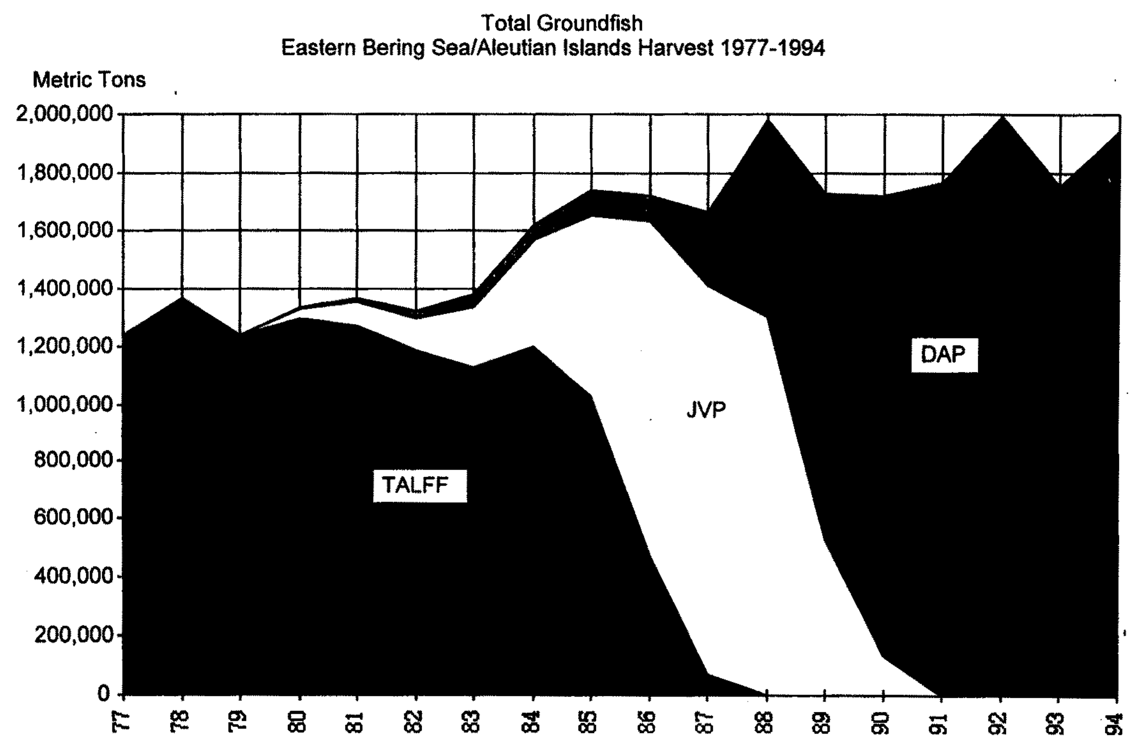
TABLE B-2.16.--*Actual catch in metric tons of all groundfish in the Eastern Bering Sea/Aleutian Islands, 1977-94.*

TOTAL GROUNDFISH

YEAR	EASTERN BERING SEA				ALEUTIAN ISLANDS				COMBINED AREAS			
	TALFF	JVP	DAP	TOTAL	TALFF	JVP	DAP	TOTAL	TALFF	JVP	DAP	TOTAL
1977	1,168,127	0	17	1,168,144	67,348	0	0	67,348	1,235,475	0	17	1,235,492
1978	1,302,478	0	31	1,302,509	61,088	0	4	61,092	1,363,566	0	35	1,363,601
1979	1,158,767	0	780	1,159,547	75,193	0	2	75,195	1,233,960	0	782	1,234,742
1980	1,187,214	32,294	2,435	1,221,943	105,640	91	2,800	108,531	1,292,854	32,385	5,235	1,330,474
1981	1,176,593	74,557	11,495	1,262,645	94,595	3,806	2,770	101,171	1,271,188	78,363	14,265	1,363,816
1982	1,102,513	89,263	22,961	1,214,737	83,696	19,258	2,121	105,075	1,186,209	108,521	25,082	1,319,812
1983	1,050,073	191,664	44,794	1,286,531	73,228	18,333	1,502	93,063	1,123,301	209,997	46,296	1,379,594
1984	1,117,372	321,667	47,450	1,486,489	77,096	51,132	4,209	132,437	1,194,468	372,799	51,659	1,618,926
1985	979,011	567,595	87,174	1,633,780	51,862	53,112	2,583	107,557	1,030,873	620,707	89,757	1,741,337
1986	459,879	1,086,055	85,785	1,631,719	14,885	70,158	6,865	91,908	474,764	1,156,213	92,650	1,723,627
1987	68,653	1,272,178	239,923	1,580,754	0	71,162	11,460	82,622	68,653	1,343,340	251,383	1,663,376
1988	0	1,234,551	667,246	1,901,796	0	66,063	12,288	78,350	0	1,300,613	679,533	1,980,147
1989	0	519,723	1,158,645	1,678,368	0	10,576	37,345	47,922	0	530,300	1,195,990	1,726,289
1990	0	133,310	1,462,534	1,595,843	0	0	128,887	128,887	0	133,310	1,591,420	1,724,730
1991	0	0	1,647,455	1,647,455	0	0	117,942	117,942	0	0	1,765,397	1,765,397
1992	0	0	1,831,954	1,831,954	0	0	164,513	164,513	0	0	1,996,467	1,996,467
1993	0	0	1,573,272	1,573,272	0	0	181,854	181,854	0	0	1,755,145	1,755,145
1994	0	0	1,771,503	1,771,503	0	0	172,290	172,290	0	0	1,943,793	1,943,793

TALFF= Total Allowable Foreign Fishing
JVP= Joint Venture Production
DAP= Domestic Annual Production

Source: NMFS.



Source: NMFS.

FIGURE B-2.25.--Actual catch of all groundfish in the Eastern Bering Sea/Aleutian Islands, 1977-94.

Pot and other gears account for less than 1 percent. Trawlers target nearly all species in the groundfish complex except sablefish and halibut, which are, except for trawl bycatch, exclusively targeted by long-liners. Long-liners target Pacific cod, sablefish, halibut, rockfish, and turbots.

2.4.5 Alaska Pollock

Distribution and Abundance. Alaska or walleye pollock are widely distributed in the EBS/AI (figure B-2.26). Higher concentrations of pollock are found on the outer continental shelf edge and slope, from just north of the Alaska Peninsula north to the Pribilof Islands and west of St. Matthew Island. The Pribilof Islands lie in the center of the most productive area for pollock production. Pollock biomass in the EBS/AI has decreased from nearly 11 million mt in 1985 to a low of 6.5 million mt in 1990 as several large year-classes passed out of the fishery (table B-2.17). Recently the abundance of pollock has increased, with the 1995 abundance estimated at about 8.7 million mt (figure B-2.27). The pollock biomass in the Eastern Bering Sea is about 8.1 million mt, in the Aleutian Islands about 0.1 million mt, and about 0.5 million mt in the Bogoslof Island area. About 70 percent of the Eastern Bering Sea biomass is in the vicinity of the Pribilof Islands. The abundance of pollock depends on a variety of factors, foremost of which are relatively stable oceanographic and weather conditions. Pollock enter the commercial fishery at about age 3 or 4 and may live to be 10 years old. Year-class strength can vary widely from year to year, but within the past 15 years, periodic strong year-classes have occurred in the population to support a stable fishery. Recently, the abundance of 1992 and 1994 year-classes appears to be particularly strong, being the third and fourth largest year-classes since 1978. These year-classes are expected to sustain a stable pollock fishery through at least the end of the century.

Harvest and Value. The EBS/AI pollock harvest is one of the highest-volume single species harvests in the world. Along with pollock harvests from other North Pacific nations, the U.S. pollock harvest ranks consistently in the top three species in annual world harvest each year. In the EBS/AI, pollock are targeted exclusively by bottom and mid-water trawl. The pollock fishery is divided into two separate seasons, called "A" and "B" seasons. The pollock "A" season, which begins in January, is directed at roe-bearing fish preparing to spawn off the continental shelf. This season occurs primarily south and east of the Pribilof Islands near Unimak Pass and lasts about 3 to 4 weeks. The pollock "B" season begins in mid-August, targets pollock for fillet and surimi, and lasts until about the end of September. The pollock "A" season is allocated 45 percent of the annual TAC, with the remaining 55 percent allocated to the "B" season. Fishing is allowed in both the EBS and Aleutian Islands concurrently. Generally, however, the EBS quota is taken first, and then the vessels move into the Aleutian Islands. The CDQ allocation may be taken at any time during the year but is generally taken after the regular "B" season. As previously mentioned, 7.5 percent of the annual pollock TAC is allocated to CDQ fisheries. The offshore or at-sea catcher/processor and mothership fishery is allocated 65 percent of the

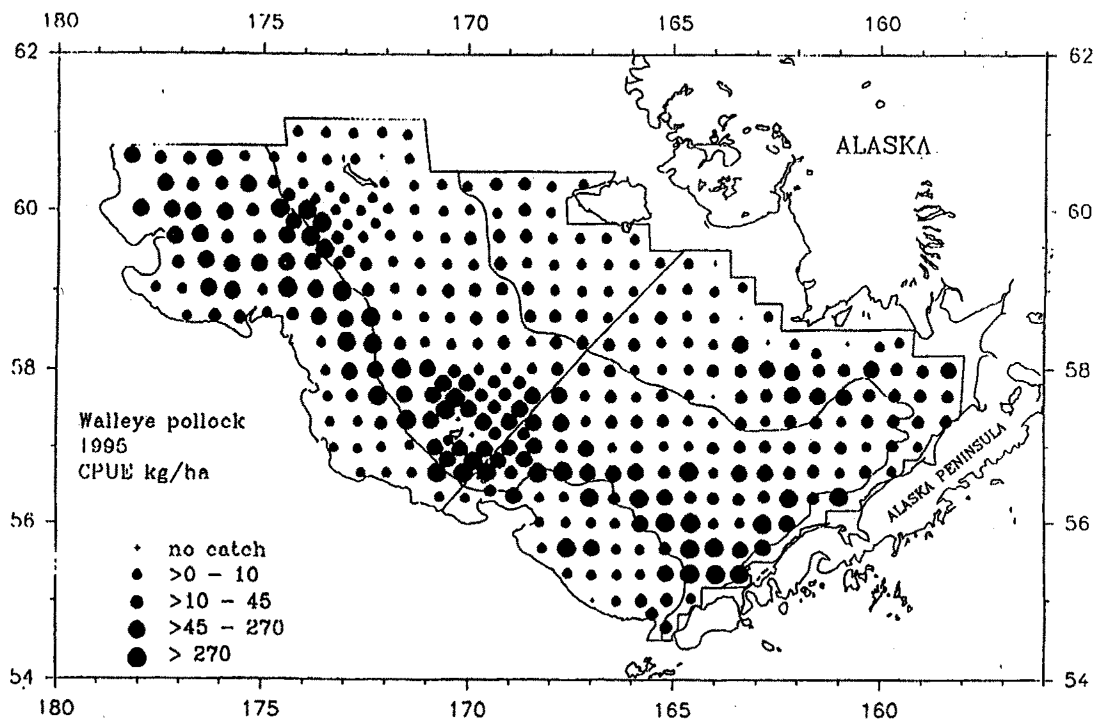


FIGURE B-2.26.--Catch per unit effort (kilograms per hectare) of Alaska or walleye pollock found during the 1995 NMFS bottom trawl stock assessment survey in the Eastern Bering Sea.

TABLE B-2.17.--*Biomass, acceptable biological catch, total allowable catch, and actual catch in metric tons for Alaska or walleye pollock in the Eastern Bering Sea/ Aleutian Islands, 1977-95*

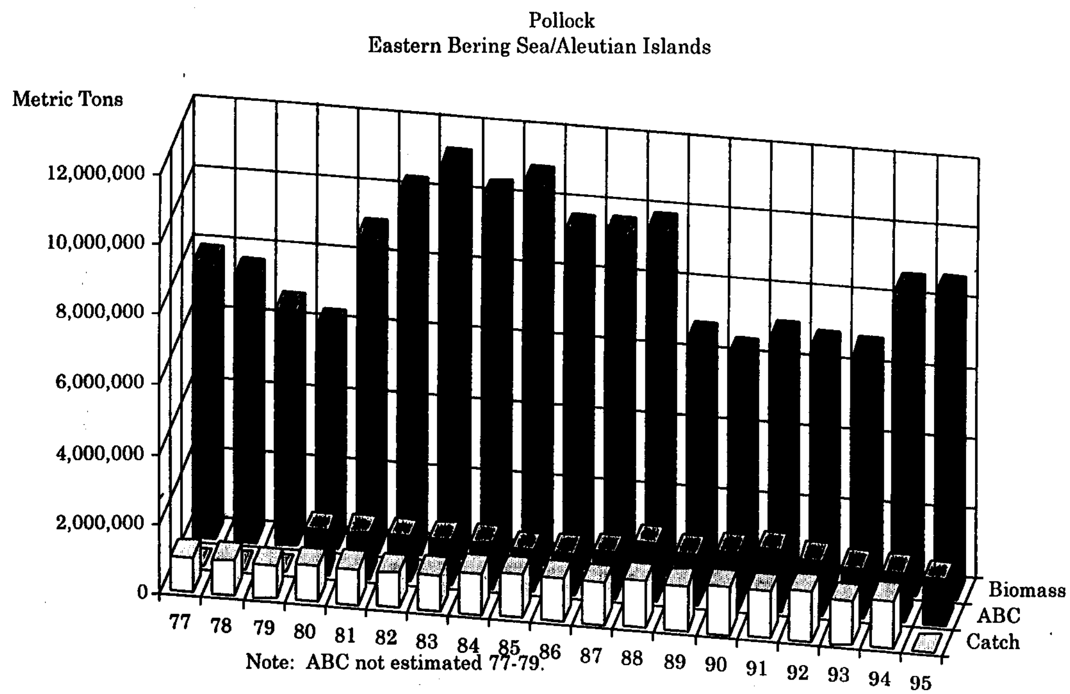
Year	BIOMASS (1)	OY/ABC (2)	TAC	CATCH
1977	7,900,000		950,000	985,995
1978	7,600,000		950,000	985,713
1979	6,700,000		950,000	923,385
1980	6,300,000	1,300,000	1,100,000	1,016,435
1981	9,000,000	1,300,000	1,100,000	1,029,021
1982	10,300,000	1,300,000	1,100,000	1,013,942
1983	11,200,000	1,300,000	1,100,000	1,041,389
1984	10,400,000	1,300,000	1,300,000	1,180,614
1985	10,900,000	1,200,000	1,300,000	1,237,489
1986	9,600,000	1,200,000	1,300,000	1,235,172
1987	9,600,000	1,300,000	1,288,000	1,207,154
1988	9,800,000	1,660,000	1,345,000	1,360,049
1989	6,771,700	1,457,900	1,345,950	1,292,543
1990	6,458,300	1,603,600	1,404,039	1,352,877
1991	7,007,553	1,777,460	1,385,000	1,346,464
1992	6,849,000	1,566,600	1,289,580	1,438,412
1993	6,746,000	1,440,700	1,251,080	1,253,749
1994	8,699,000	1,418,350	1,387,600	1,371,154
1995	8,711,000	1,328,700	1,307,600	

Note 1: Exploitable biomass of pollock not measued in Aleutian Islands since 1991.
Note 2: OYs (optimum yield) were used in Eastern Bering Sea/Aleutian Island groundfish allocations from 1977 to 1981 and are essentially equivalent to ABCs since 1982.

Source: NMFS.

remaining annual pollock TAC; 35 percent is allocated to the shore-based catcher vessel fleet. Major shore-based processing centers include Dutch Harbor and Akutan Island. No pollock is currently processed in St. Paul, although it offers a potential base for factory trawler and mothership-based catcher vessels to re-provision, change crews, and offload finished product.

The pollock TAC has been consistent in recent years at about 1.3 to 1.4 million mt. Pollock harvests in the EBS/AI have remained very stable over the past 15 years, ranging from a low of 1.0 million mt to a high of 1.4 million mt (table B-2.18 and figure B-2.28). The EBS has contributed 96 percent of the pollock harvest, with the



Source: NMFS.

FIGURE B-2.27.--Biomass, acceptable biological catch (ABC), and actual catch of Alaska or walleye pollock in the Eastern Bering Sea/Aleutian Islands, 1977-95.

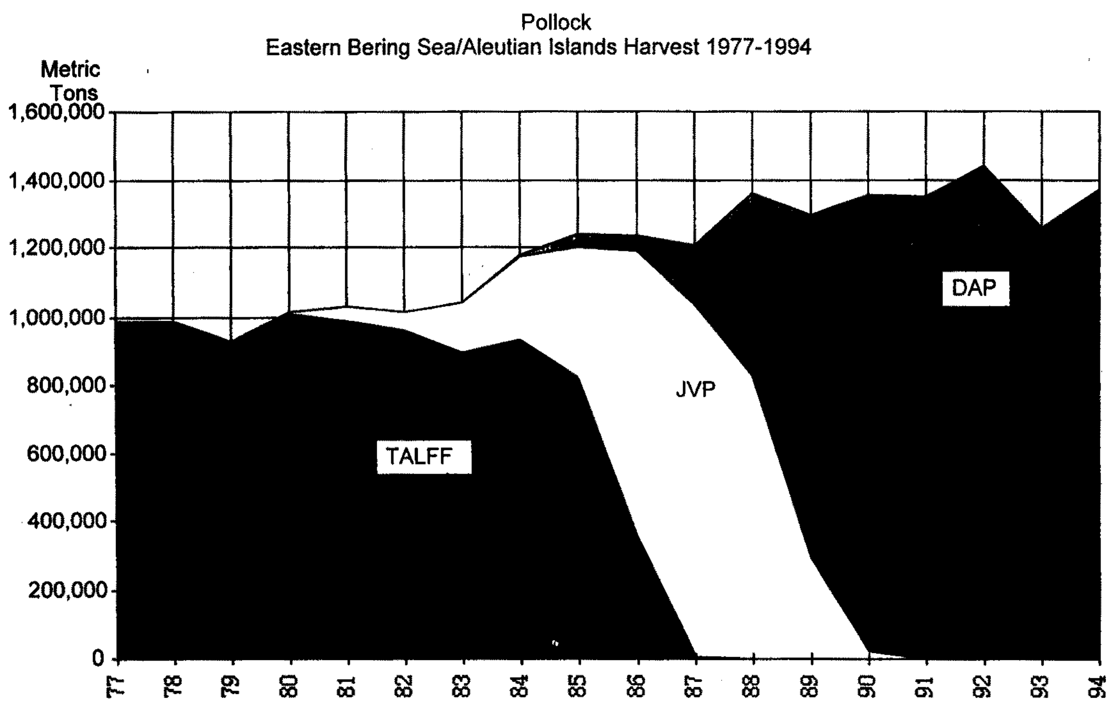
TABLE B-2.18.--*Actual catch in metric tons of Alaska or walleye pollock in the Eastern Bering Sea/Aleutian Islands, 1977-94.*

POLLOCK

YEAR	EASTERN BERING SEA				ALEUTIAN ISLANDS				COMBINED AREAS			
	TALFF	JVP	DAP	TOTAL	TALFF	JVP	DAP	TOTAL	TALFF	JVP	DAP	TOTAL
1977	978,370	0	0	978,370	7,625	0	0	7,625	985,995	0	0	985,995
1978	979,431	0	0	979,431	6,282	0	0	6,282	985,713	0	0	985,713
1979	913,881	0	0	913,881	9,504	0	0	9,504	923,385	0	0	923,385
1980	947,800	10,479	0	958,279	58,156	0	0	58,156	1,005,956	10,479	0	1,016,435
1981	931,567	41,938	0	973,505	55,516	0	0	55,516	987,083	41,938	0	1,029,021
1982	903,342	52,622	0	955,964	55,995	1,983	0	57,978	959,337	54,605	0	1,013,942
1983	834,984	146,467	912	982,363	56,479	2,547	0	59,026	891,463	149,014	912	1,041,389
1984	862,088	230,314	6,727	1,099,129	70,900	6,694	3,891	81,485	932,988	237,008	10,618	1,180,614
1985	770,418	370,257	38,084	1,178,759	50,864	7,283	583	58,730	821,282	377,540	38,667	1,237,489
1986	337,150	804,842	47,363	1,189,355	14,779	30,261	777	45,817	351,929	835,103	48,140	1,235,172
1987	3,596	1,003,885	170,898	1,178,379	0	28,526	249	28,775	3,596	1,032,411	171,147	1,207,154
1988	0	785,211	531,324	1,316,535	0	41,202	2,312	43,514	0	826,413	533,636	1,360,049
1989	0	277,186	999,338	1,276,524	0	10,569	5,450	16,018	0	287,755	1,004,788	1,292,543
1990	0	22,397	1,257,611	1,280,007	0	0	72,870	72,870	0	22,397	1,330,481	1,352,877
1991	0	0	1,268,360	1,268,360	0	0	78,104	78,104	0	0	1,346,464	1,346,464
1992	0	0	1,384,376	1,384,376	0	0	54,036	54,036	0	0	1,438,412	1,438,412
1993	0	0	1,199,675	1,199,675	0	0	54,074	54,074	0	0	1,253,749	1,253,749
1994	0	0	1,314,057	1,314,057	0	0	57,097	57,097	0	0	1,371,154	1,371,154

TALFF= Total Allowable Foreign Fishing
JVP= Joint Ventuure Production
DAP= Domestic Annual Production

Source: NMFS.



Source: NMFS.

FIGURE B-2.28.--Actual catch of Alaska or walleye pollock in the Eastern Bering Sea/Aleutian Islands, 1977-94.

remaining 6 percent from the Aleutian Islands. The pollock harvest rate has ranged from a low of 11 percent to a high of 21 percent over the past 10 years. The 1994 harvest of 1.37 million mt was conservatively valued at about $400 million at the ex-vessel level. The 1995 harvest and value of pollock from the EBS/AI is estimated to be similar to that of 1994. The outlook for pollock harvests and values in the EBS/AI is for stable production through the end of the century and stable or somewhat increasing value, as the demand for whitefish worldwide is expected to increase.

2.4.6 Pacific Cod

Distribution and Abundance. Pacific cod inhabit most of the EBS shelf region and are also found in less abundance in the Aleutian Islands. Pacific cod are most abundant in-shore along the north coast of the Alaska Peninsula, around the Pribilof Islands, and north on the outer continental shelf to St. Matthew Island (figure B-2.29). Pacific cod concentrate in the deeper water of the outer continental shelf edge for spawning from January to March and migrate into shallower waters on the continental shelf to feed in the summer and fall. Pacific cod enter the fishery at about age 4 or 5 and may live up to 12 years. Pacific cod biomass has fluctuated from a low of 655,000 mt in 1993 to a record high of 1.6 million mt in 1994 (table B-2.19 and figure B-2.30). This large increase in abundance is due to particularly strong 1989, 1990, and 1991 year-classes in the fishery and an apparently exceptionally large 1992 year-class about to enter the fishery. This year-class is expected to increase the biomass of Pacific cod significantly in the EBS over the next 5 to 6 years.

Harvest and Value. Pacific cod are targeted by large shore-based and offshore fleets operating bottom and mid-water trawls, as well as a long-line catcher/processor fleet and a smaller jig boat and pot fleet. The length of the Pacific cod fishery depends mainly on halibut and crab bycatch quota attainment. The fishery begins on January 20, but full participation does not occur until after the pollock "A" season is completed in mid-February. The majority of the Pacific cod harvest occurs in the spring and early summer. The entire fishery is active for 90 to 120 days each year in the EBS/AI. For the 1995 season, the NPFMC allocated 54 percent of the annual TAC to trawl fisheries, 44 percent to long-line and pot fisheries, and 2 percent to jig fisheries. Pacific cod are not allocated between shore-based and at-sea fisheries. Long-line fishermen concentrate their efforts in the vicinity of St. Paul Island during much of the year.

The TAC for Pacific cod in the EBS/AI has increased from 164,500 mt in 1993 to 250,000 mt in 1995 (table B-2.19 and figure B-2.30). The harvest of Pacific cod decreased from a peak of 206,000 mt in 1992 to 167,000 mt in 1993, but increased again to 196,600 mt in 1994 (tables B-2.19 and B-2.20 and figure B-2.31). The 1995 harvest is expected to be more than 200,000 mt, and possibly near the 250,000-mt TAC. Pacific cod have been exploited at a rate of between 10 percent and 26 percent of available biomass, a very conservative harvest strategy. Pacific cod harvest has been limited by halibut and crab bycatch limits, not the available resource. The 1994

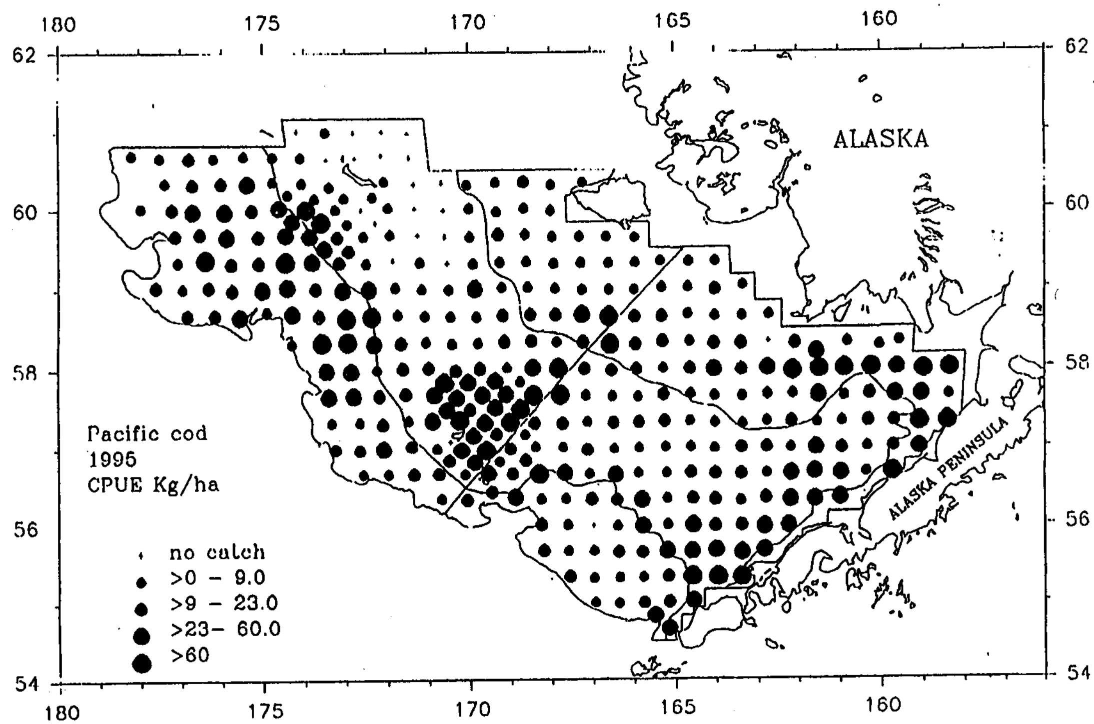


FIGURE B-2.29.--Catch per unit effort (kilograms per hectare) of Pacific cod found during the 1995 NMFS bottom trawl stock assessment survey in the Eastern Bering Sea.

TABLE B-2.19.--*Biomass, acceptable biological catch, total allowable catch, and actual catch in metric tons for Pacific cod in the Eastern Bering Sea/ Aleutian Islands, 1977-95*

Year	BIOMASS (1)	OY/ABC (2)	TAC	CATCH
1977	390,800		58,000	36,597
1978	390,800		70,500	45,838
1979	871,100		70,500	39,354
1980	992,100		70,700	51,649
1981	918,900	160,000	78,700	62,410
1982	1,092,700	168,000	78,700	66,660
1983	1,263,300	298,200	120,000	97,847
1984	1,136,600	291,300	210,000	127,940
1985	1,094,500	347,400	220,000	144,272
1986	1,315,800	249,300	229,000	138,037
1987	1,340,606	400,000	280,000	157,612
1988	1,366,000	385,300	200,000	197,055
1989	1,190,000	370,600	226,079	168,382
1990	1,389,500	417,000	199,975	171,009
1991	1,030,000	229,000	229,000	172,158
1992	910,000	182,000	176,700	206,129
1993	655,000	164,500	164,500	167,390
1994	925,000	191,000	191,000	196,569
1995	1,620,000	328,000	250,000	

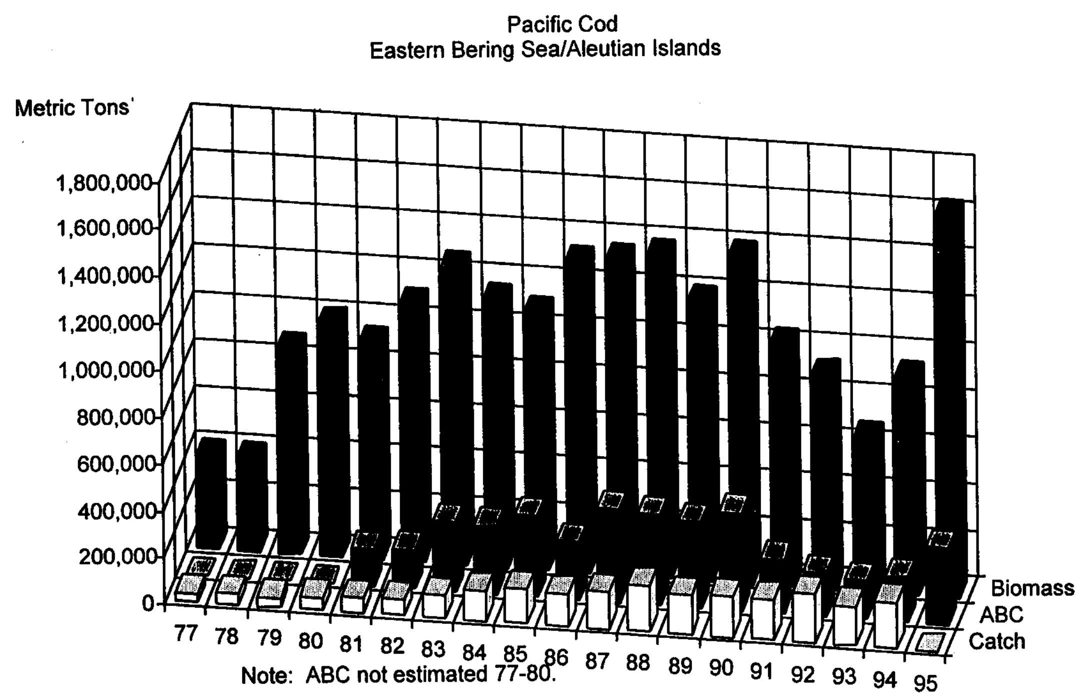
Note 1: Exploitable biomass in 1977 based on 1978 estimate.
Note 2: OYs (optimum yield) were used in Eastern Bering Sea/Aleutian Island groundfish allocations from 1977 to 1981 and are essentially equivalent to ABCs since 1982.

Source: NMFS.

Pacific cod harvest ex-vessel value was conservatively estimated at about $92 million. The outlook for future harvests of Pacific cod is encouraging, given the rapidly increasing biomass. The main limitation on the harvest of Pacific cod will remain bycatch quotas on crab and halibut.

2.4.7 Yellowfin Sole.

Distribution and Abundance. Yellowfin sole inhabit most of the inner-EBS shelf region and are most abundant in-shore along the Alaska mainland east of the Pribilof Islands (figure B-2.32). The sole are concentrated in water shallower than 300 feet. Yellowfin sole begin entering the fishery at about age 7, are fully available to



Source: NMFS.

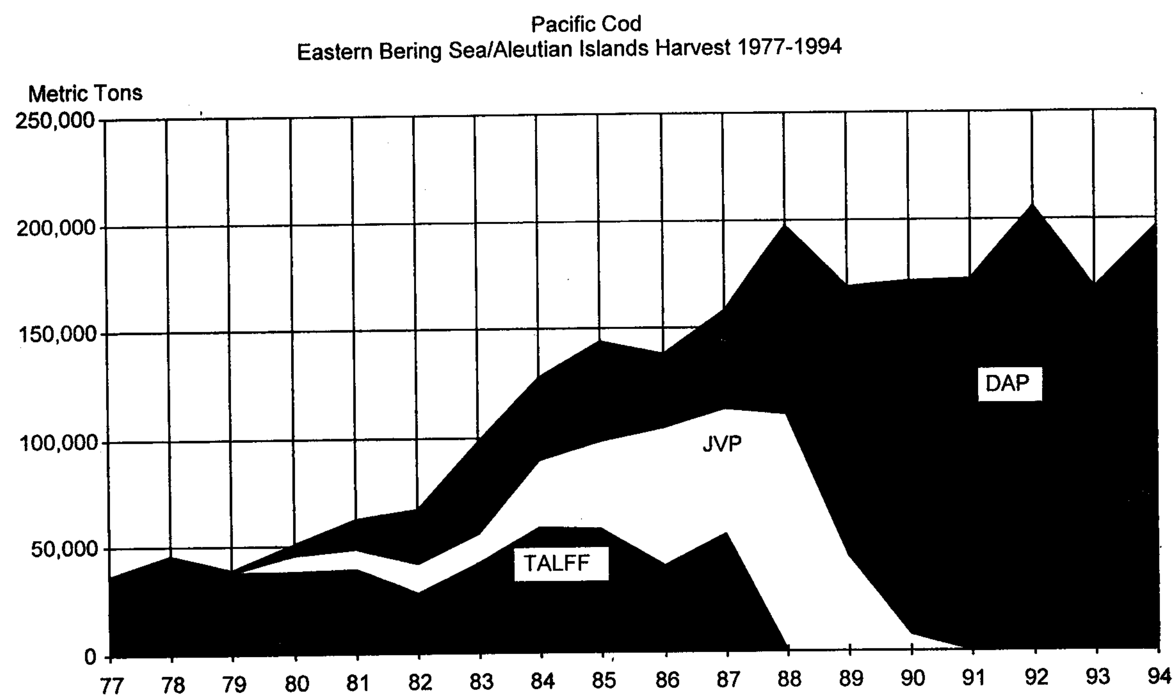
FIGURE B-2.30.--Biomass, acceptable biological catch (ABC), and actual catch of Pacific cod in the Eastern Bering Sea/Aleutian Islands, 1977-95.

TABLE B-2.20.--*Actual catch in metric tons of Pacific cod in the Eastern Bering Sea/Aleutian Islands, 1977-94.*

YEAR	EASTERN BERING SEA				ALEUTIAN ISLANDS				COMBINED AREAS			
	TALFF	JVP	DAP	TOTAL	TALFF	JVP	DAP	TOTAL	TALFF	JVP	DAP	TOTAL
1977	33,320	0	15	33,335	3,262	0	0	3,262	36,582	0	15	36,597
1978	42,512	0	31	42,543	3,291	0	4	3,295	45,803	0	35	45,838
1979	32,981	0	780	33,761	5,591	0	2	5,593	38,572	0	782	39,354
1980	35,058	8,370	2,433	45,861	2,905	86	2,797	5,788	37,963	8,456	5,230	51,649
1981	36,198	7,410	11,368	54,976	2,915	1,749	2,770	7,434	39,113	9,159	14,138	62,410
1982	26,179	9,312	22,773	58,264	1,995	4,280	2,121	8,396	28,174	13,592	24,894	66,660
1983	39,235	9,662	40,520	89,417	2,271	4,700	1,459	8,430	41,506	14,362	41,979	97,847
1984	57,233	24,382	38,344	119,959	1,277	6,390	314	7,981	58,510	30,772	38,658	127,940
1985	56,338	35,634	45,363	137,335	839	5,638	460	6,937	57,177	41,272	45,823	144,272
1986	39,855	57,827	33,449	131,131	5	6,115	786	6,906	39,860	63,942	34,235	138,037
1987	54,746	47,722	41,937	144,405	0	10,435	2,772	13,207	54,746	58,157	44,709	157,612
1988	0	106,592	85,297	191,889	0	3,300	1,866	5,166	0	109,892	87,163	197,055
1989	0	44,612	119,228	163,840	0	6	4,536	4,542	0	44,618	123,764	168,382
1990	0	8,078	154,850	162,927	0	0	8,081	8,081	0	8,078	162,931	171,009
1991	0	0	165,444	165,444	0	0	6,714	6,714	0	0	172,158	172,158
1992	0	0	163,240	163,240	0	0	42,889	42,889	0	0	206,129	206,129
1993	0	0	133,156	133,156	0	0	34,234	34,234	0	0	167,390	167,390
1994	0	0	175,748	175,748	0	0	20,821	20,821	0	0	196,569	196,569

TALFF= Total Allowable Foreign Fishing
JVP= Joint Venture Production
DAP= Domestic Annual Production

Source: NMFS.



Source: NMFS.

FIGURE B-2.31.--Actual catch of Pacific cod in the Eastern Bering Sea/Aleutian Islands, 1977-94.

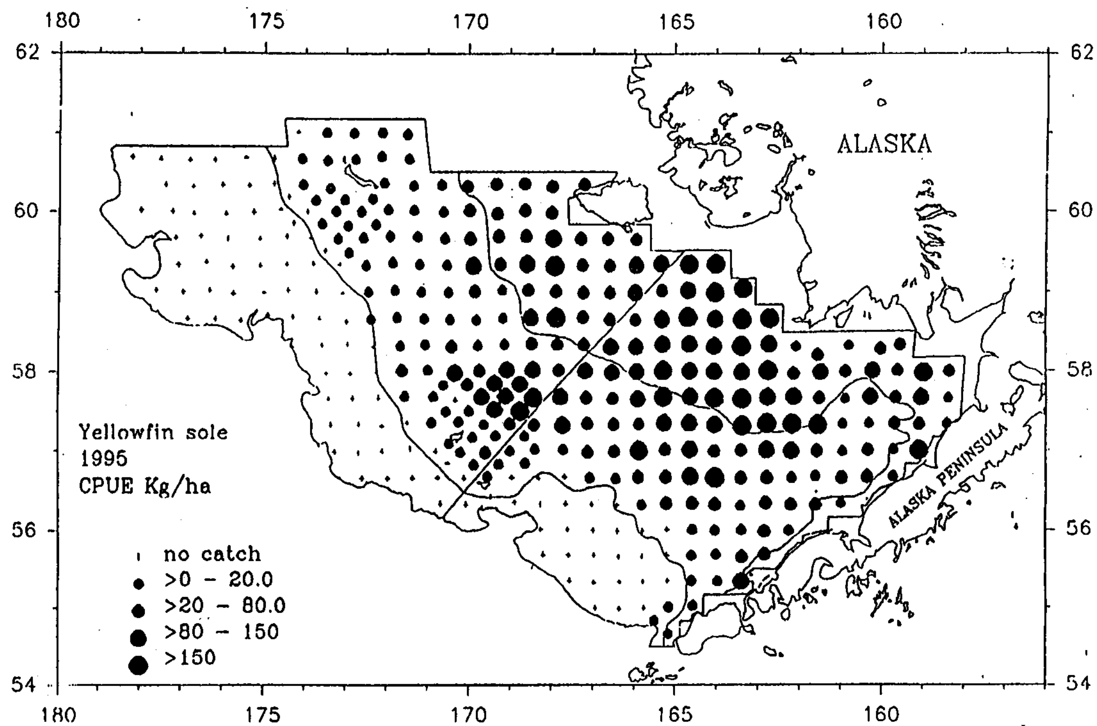


FIGURE B-2.32.--Catch per unit effort (kilograms per hectare) of yellowfin sole found during the 1995 NMFS bottom trawl stock assessment survey in the Eastern Bering Sea.

the fishery by age 13, and may live to be up to 26 years old. The abundance of yellowfin sole increased slowly during the 1970's and early 1980's to a peak during the mid-1980's (table B-2.21 and figure B-2.33). The resource has remained abundant and stable until recently (1994), when a series of strong year-classes resulted in an increasing trend in abundance to record levels. Being a slow-growing, long-lived species, the fishery has been supported by the strong 1981 and 1983 year-classes. However, the recent increase in abundance is due to particularly strong 1987, 1988, and 1990 year-classes. These year-classes are expected to increase the biomass of yellowfin sole significantly in the EBS over the next 5 to 8 years.

Harvest and Value. Yellowfin sole are targeted by the at-sea catcher/processor bottom trawl fleet. The length of the yellowfin sole fishery depends mainly on halibut and crab bycatch quota attainment and participation of the fleet in other target fisheries. The fishery is allowed to begin on January 20, but full participation does not occur until the close of the pollock "A" season and the Pacific cod season in mid-April. The majority of yellowfin sole are harvested in summer and fall. In 1995, the fishery began in mid-April and ended in mid-November. The bulk of the fishery is conducted just east and north of St. Paul Island. Virtually all yellowfin sole are processed at sea for Asian markets.

The TAC for yellowfin sole in the EBS/AI has increased from 135,000 mt in 1991 to 190,000 mt in 1995 (table B-2.21 and figure B-2.33). The harvest of yellowfin sole decreased from more than 227,000 mt in 1985 to a low of 80,000 mt in 1991, as bycatch quotas limited the harvest (table B-2.22 and figure B-2.34). The 1995 harvest is expected to be more than 150,000 mt and limited only by bycatch quota. The exploitation rate has ranged from 4 percent to 10 percent in recent years. The 1994 yellowfin sole ex-vessel value was estimated at about $13.6 million. The outlook for future harvests of yellowfin sole is encouraging given the increasing biomass. The main limitation on additional harvest will continue to be bycatch quotas of crab and halibut.

2.4.8 Rock Sole.

Distribution and Abundance. Rock sole inhabit most of the EBS shelf region and are most abundant in-shore along the Alaska mainland east of the Pribilof Islands (figure B-2.35) concentrating in water shallower than 300 feet. Rock sole begin entering the fishery at about age 4, are completely recruited by age 9, and may live to be 25 years old. Rock sole abundance has increased slowly but consistently since the late 1970's to a peak of 2.3 million mt in 1995 (table B-2.23 and figure B-2.36). Rock sole in the EBS have increased in abundance due to particularly good recruitment of a successive series of strong year-classes to the fishery. Recent strong year-classes are expected to increase the biomass of rock sole in the EBS significantly over the next 5 to 8 years or longer.

TABLE B-2.21.--*Biomass, acceptable biological catch, total allowable catch, and actual catch in metric tons for yellowfin sole in the Eastern Bering Sea/ Aleutian Islands, 1977-95*

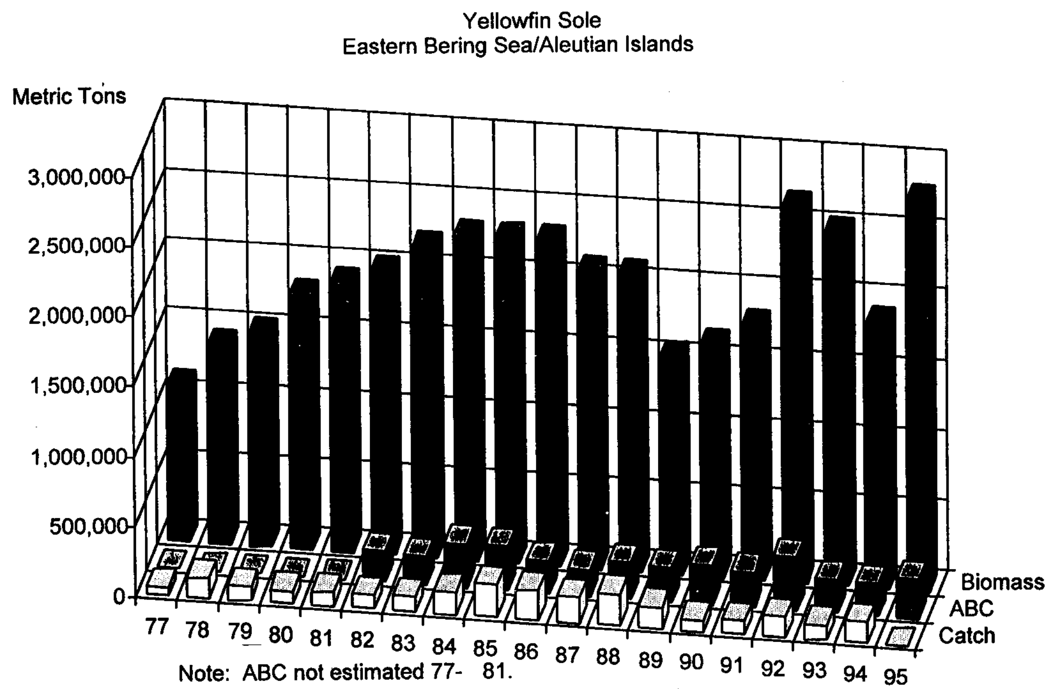
Year	BIOMASS (1)	OY/ABC (2)	TAC	CATCH
1977	1,100,000		106,000	58,373
1978	1,400,000		126,000	138,433
1979	1,500,000		126,000	99,017
1980	1,800,000		117,000	87,391
1981	1,900,000		117,000	97,301
1982	2,000,000	214,500	117,000	95,712
1983	2,200,000	200,000	117,000	108,385
1984	2,300,000	310,000	230,000	159,526
1985	2,300,000	310,000	226,900	227,107
1986	2,300,000	230,000	209,500	208,597
1987	2,100,000	187,000	187,000	181,428
1988	2,093,000	254,000	254,000	223,154
1989	1,530,000	241,000	193,952	152,775
1990	1,640,400	278,900	176,502	80,584
1991	1,790,000	250,600	135,000	96,135
1992	2,660,000	372,000	199,750	146,946
1993	2,500,000	238,000	187,000	106,101
1994	1,880,000	230,000	150,325	144,544
1995	2,770,000	277,000	190,000	

Note 1: Exploitable biomass based on cohort analysis.

Note 2: OYs (optimum yield) were used in Eastern Bering Sea/Aleutian Island groundfish allocations from 1977 to 1981 and are essentially equivalent to ABCs since 1982.

Source: NMFS.

Harvest and Value. Rock sole are targeted by the at-sea catcher/processor bottom trawl fleet. The length of the rock sole fishery depends mainly on halibut and crab bycatch quota attainment and participation of the fleet in other target fisheries. The fishery begins in January, but full participation does not occur until after the close of the pollock "A" season and the Pacific cod season in mid-April. The majority of rock sole are harvested in mid-February through early April when the females are ripe with roe, the primary target of the fishery. In 1995, the fishery began in January, and most harvest was taken by mid-April. The bulk of the fishery is conducted just east and north of St. Paul Island. Virtually all rock sole are processed at sea for Asian markets.



Source: NMFS.

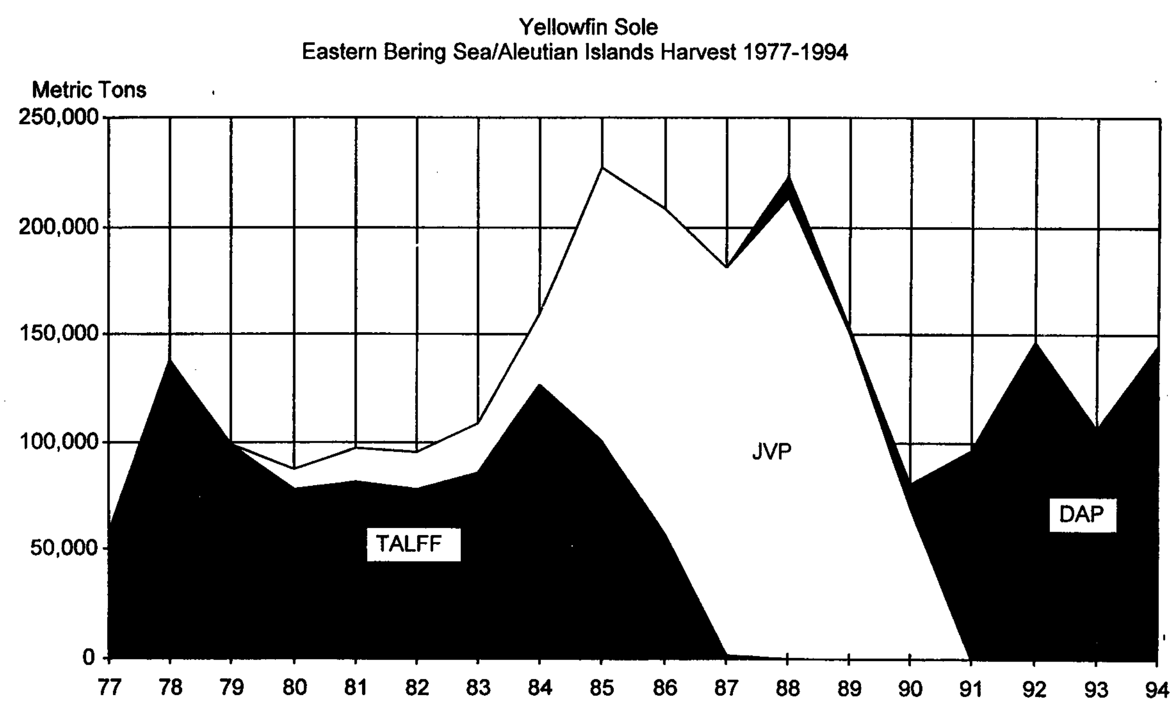
FIGURE B-2.33.--Biomass, acceptable biological catch (ABC), and actual catch of yellowfin sole in the Eastern Bering Sea/Aleutian Islands, 1977-95.

TABLE B-2.22.--*Actual catch in metric tons of yellowfin sole in the Eastern Bering Sea/Aleutian Islands, 1977-94.*

	EASTERN BERING SEA				ALEUTIAN ISLANDS				COMBINED AREAS			
YEAR	TALFF	JVP	DAP	TOTAL	TALFF	JVP	DAP	TOTAL	TALFF	JVP	DAP	TOTAL
1977	58,373	0	0	58,373	0	0	0	0	58,373	0	0	58,373
1978	138,433	0	0	138,433	0	0	0	0	138,433	0	0	138,433
1979	99,017	0	0	99,017	0	0	0	0	99,017	0	0	99,017
1980	77,768	9,623	0	87,391	0	0	0	0	77,768	9,623	0	87,391
1981	81,255	16,046	0	97,301	0	0	0	0	81,255	16,046	0	97,301
1982	78,331	17,381	0	95,712	0	0	0	0	78,331	17,381	0	95,712
1983	85,874	22,511	0	108,385	0	0	0	0	85,874	22,511	0	108,385
1984	126,762	32,764	0	159,526	0	0	0	0	126,762	32,764	0	159,526
1985	100,706	126,401	0	227,107	0	0	0	0	100,706	126,401	0	227,107
1986	57,197	151,400	0	208,597	0	0	0	0	57,197	151,400	0	208,597
1987	1,811	179,613	4	181,428	0	0	0	0	1,811	179,613	4	181,428
1988	0	213,322	9,832	223,154	0	0	0	0	0	213,322	9,832	223,154
1989	0	151,111	1,664	152,775	0	0	0	0	0	151,111	1,665	152,775
1990	0	69,677	10,907	80,584	0	0	0	0	0	69,677	10,907	80,584
1991	0	0	94,755	94,755	0	0	1,380	1,380	0	0	96,135	96,135
1992	0	0	146,942	146,942	0	0	4	4	0	0	146,946	146,946
1993	0	0	106,101	106,101	0	0	0	0	0	0	106,101	106,101
1994	0	0	144,544	144,544	0	0	0	0	0	0	144,544	144,544

TALFF= Total Allowable Foreign Fishing
JVP= Joint Ventuure Production
DAP= Domestic Annual Production

Source: NMFS.



Source: NMFS.

FIGURE B-2.34.--Actual catch of yellowfin sole in the Eastern Bering Sea/Aleutian Islands, 1977-94.

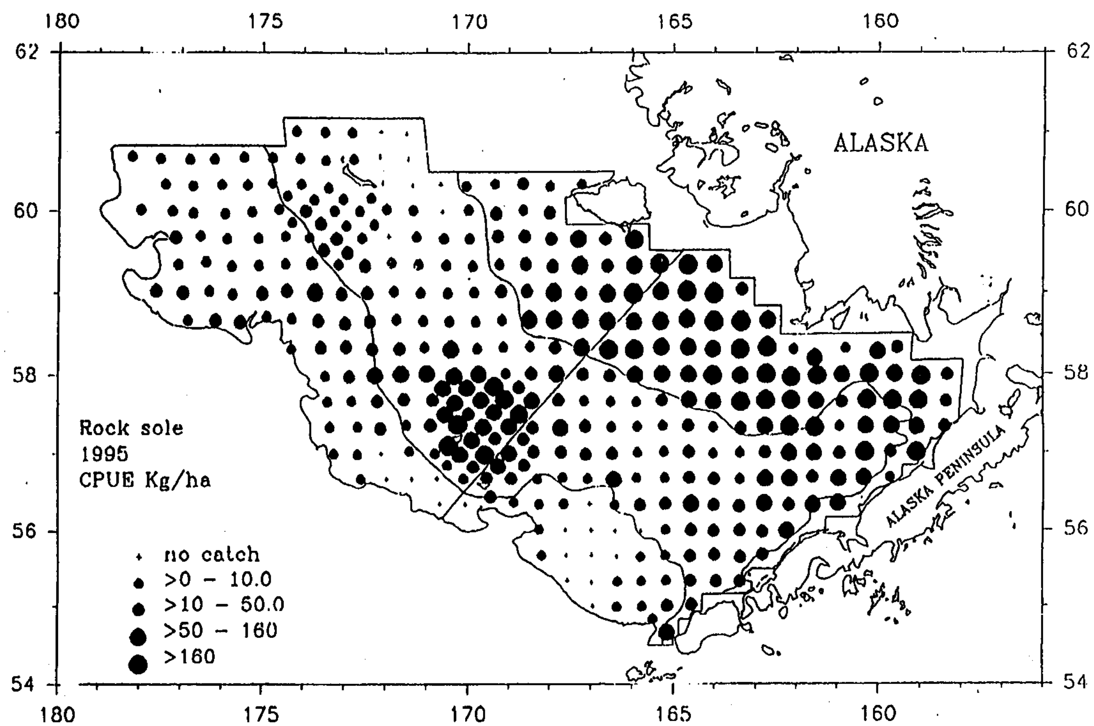


FIGURE B-2.35.--Catch per unit effort (kilograms per hectare) of rock sole found during the 1995 NMFS bottom trawl stock assessment survey in the Eastern Bering Sea.

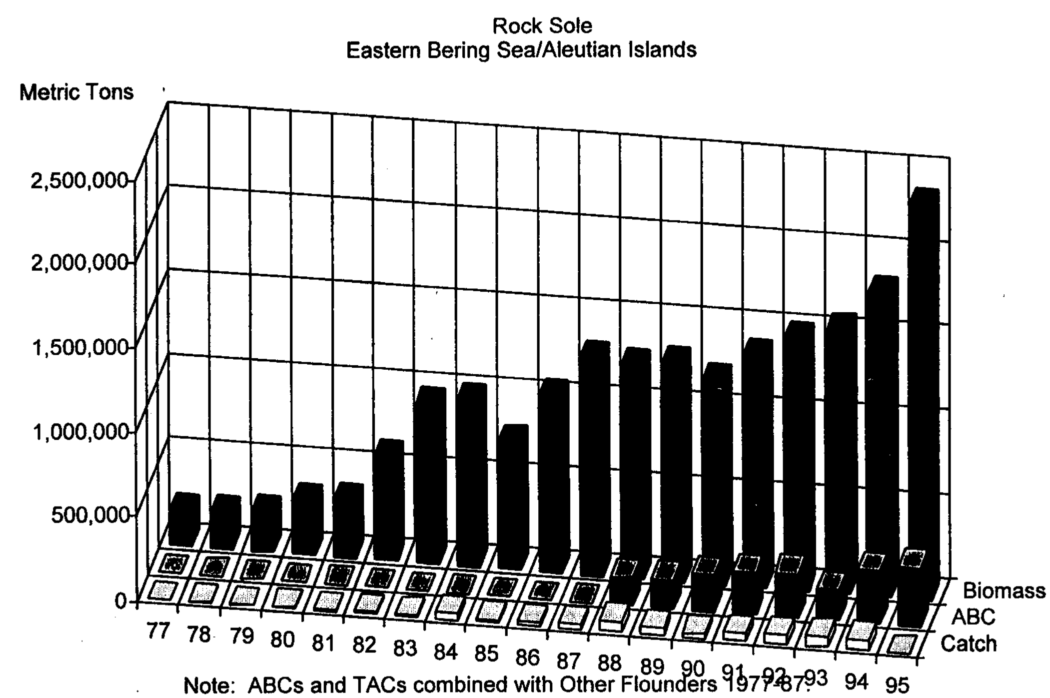
TABLE B-2.23.--*Biomass, acceptable biological catch, total allowable catch, and actual catch in metric tons for rock sole in the Eastern Bering Sea/ Aleutian Islands, 1977-95*

Year	BIOMASS (1)	OY/ABC (2)	TAC	CATCH
1977	204,000			2,914
1978	204,000			3,323
1979	223,200			1,468
1980	312,300			7,601
1981	330,900			9,021
1982	600,700			11,843
1983	934,500			13,618
1984	973,900			37,679
1985	743,600			18,750
1986	1,040,600			19,611
1987	1,276,700			26,555
1988	1,250,000	166,000		63,258
1989	1,277,900	171,000	77,148	44,343
1990	1,193,900	216,300	67,359	24,047
1991	1,364,000	246,500	76,500	46,681
1992	1,481,900	260,800	40,000	51,956
1993	1,550,000	185,000	63,750	63,953
1994	1,790,000	313,000	75,000	60,544
1995	2,330,000	347,000	60,000	

Note 1: Exploitable biomass estimates in 1977 and 1978 based on 1978 trawl survey result

Note 2: OYs (optimum yield) were used in Eastern Bering Sea/Aleutian Island groundfish allocations from 1977 to 1981 and are essentially equivalent to ABCs since 1982.

The TAC for rock sole in the EBS/AI has remained fairly constant between 60,000 and 75,000 mt during the past 3 years (table B-2.23 and figure B-2.36). The TAC is limited not by biomass but by expected harvest capability under bycatch limitations and the overall groundfish harvest cap of 2 million mt in the EBS/AI. The harvest of rock sole increased from 24,000 mt in 1990 to about 60,000 mt recently (table B-2.24 and figure B-2.37). The 1995 harvest is expected to be more than 60,000 mt and limited only by bycatch quota. The exploitation rate has ranged from 2 percent to 5 percent in recent years. The outlook for future harvests of rock sole is encouraging, given the increasing biomass. The main limitation on additional harvest will remain bycatch quotas on crab and halibut.



Source: NMFS.

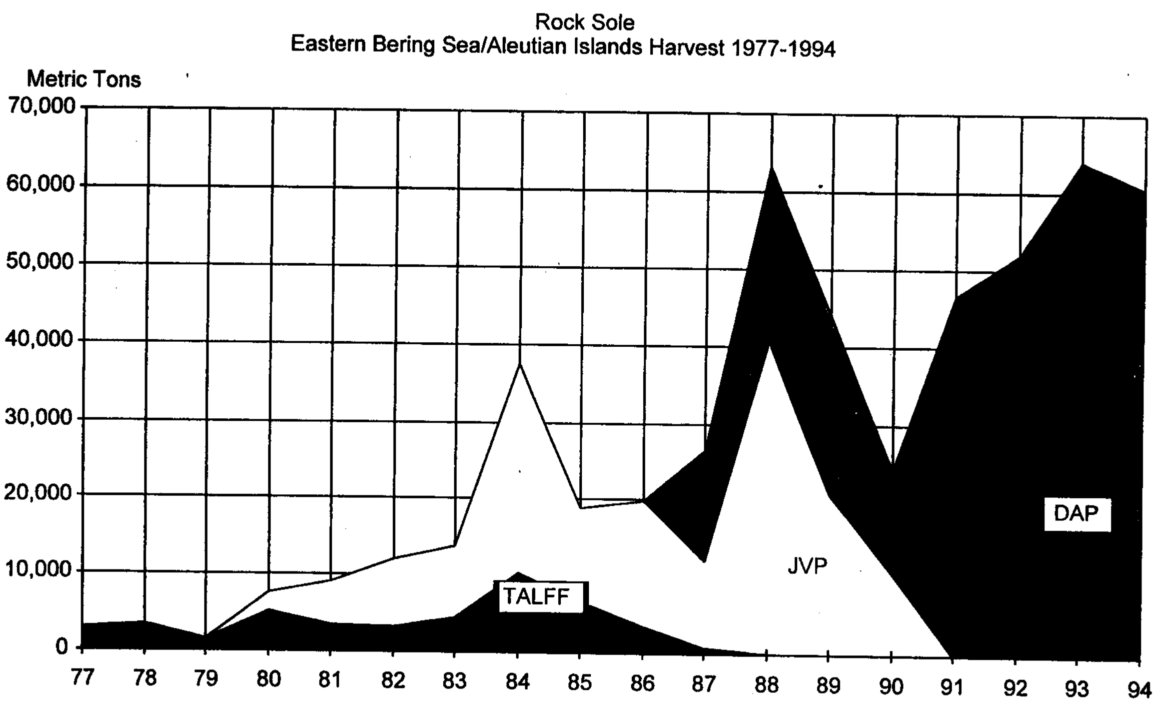
FIGURE B-2.36.--Biomass, acceptable biological catch (ABC), and actual catch of rock sole in the Eastern Bering Sea/Aleutian Islands, 1977-95.

TABLE B-2.24.--*Actual catch in metric tons of rock sole in the Eastern Bering Sea/Aleutian Islands, 1977-94.*

	EASTERN BERING SEA				ALEUTIAN ISLANDS				COMBINED AREAS			
YEAR	TALFF	JVP	DAP	TOTAL	TALFF	JVP	DAP	TOTAL	TALFF	JVP	DAP	TOTAL
1977	2,914	0	0	2,914	0	0	0	0	2,914	0	0	2,914
1978	3,323	0	0	3,323	0	0	0	0	3,323	0	0	3,323
1979	1,468	0	0	1,468	0	0	0	0	1,468	0	0	1,468
1980	5,132	2,469	0	7,601	0	0	0	0	5,132	2,469	0	7,601
1981	3,480	5,541	0	9,021	0	0	0	0	3,480	5,541	0	9,021
1982	3,169	8,674	0	11,843	0	0	0	0	3,169	8,674	0	11,843
1983	4,478	9,140	0	13,618	0	0	0	0	4,478	9,140	0	13,618
1984	10,156	27,523	0	37,679	0	0	0	0	10,156	27,523	0	37,679
1985	6,671	12,079	0	18,750	0	0	0	0	6,671	12,079	0	18,750
1986	3,394	16,217	0	19,611	0	0	0	0	3,394	16,217	0	19,611
1987	776	11,136	14,209	26,121	0	0	434	434	776	11,136	14,643	26,555
1988	0	40,844	22,374	63,218	0	0	40	40	0	40,844	22,414	63,258
1989	0	20,759	23,544	44,303	0	0	41	41	0	20,759	23,585	44,343
1990	0	10,492	13,132	23,624	0	0	423	423	0	10,492	13,555	24,047
1991	0	0	46,681	46,681	0	0	0	0	0	0	46,681	46,681
1992	0	0	51,720	51,720	0	0	236	236	0	0	51,956	51,956
1993	0	0	63,635	63,635	0	0	318	318	0	0	63,953	63,953
1994	0	0	60,236	60,236	0	0	308	308	0	0	60,544	60,544

TALFF= Total Allowable Foreign Fishing
JVP= Joint Ventuure Production
DAP= Domestic Annual Production

Source: NMFS.



Source: NMFS.

FIGURE B-2.37.--Actual catch of rock sole in the Eastern Bering Sea/Aleutian Islands, 1977-94.

2.4.9 Other Flatfish.

Distribution and Abundance. Other flatfish resources of lesser commercial significance but abundant in the EBS include flathead sole, Alaska plaice, Greenland turbot, and arrowtooth flounder. These resources are widely distributed, but most abundant on the outer continental shelf (figure B-2.38). These resources, although of little current commercial importance, also have generally increased in abundance (except Greenland turbot, which has declined) since the late 1970's (table B-2.25 and figure B-2.39). Currently the EBS biomass is estimated at just more than 2.0 million mt. These flatfish resources have increased mainly due to beneficial environmental conditions and a lack of significant exploitation. With the exception of Greenland turbot, which is considered a depressed stock, the species are expected to remain stable or continue to increase in the foreseeable future.

Harvest and Value. This "other flatfish" group is generally taken as bycatch in the directed yellowfin sole and rock sole fisheries by the at-sea catcher/processor bottom trawl fleet. Greenland turbot are taken in a directed long-line fishery in the Aleutian Islands and north of the Pribilof Islands, to the west of St. Matthew Island on the continental slope edge. The bulk of the "other flatfish" fishery is conducted just east and north of St. Paul Island. With the exception of Greenland turbot, nearly all these flatfish are discarded. Only small amounts are processed at sea for Asian markets in a manner similar to that for yellowfin sole.

The TAC for the "other flatfish" group in the EBS/AI has remained fairly constant between 66,000 and 82,000 mt during the past 3 years (table B-2.25 and figure B-2.39). The TAC is limited not by biomass but by the expected harvest capability under bycatch limitations and the overall groundfish harvest cap of 2 million mt in the EBS/AI. The harvest of these flatfish has remained fairly stable at about 47,000 to 55,000 mt annually (table B-2.26 and figure B-2.40). The 1995 harvest is expected to be more than 60,000 mt, limited only by bycatch quota. The main limitation on additional harvest will remain bycatch quotas on crab and halibut, lack of interest in a directed fishery for the these species, and depressed condition of the Greenland turbot resource.

2.4.10 Pacific Halibut.

Distribution and Abundance. Pacific halibut are widely distributed in the EBS (figure B-2.41). High concentrations are found around the Pribilof Islands, along the outer continental shelf to the south, and in in-shore areas along the Alaska mainland. The exploitable biomass of Pacific halibut in the EBS was estimated at about 17,400 mt in 1993. The overall trend in the biomass has been down, with an 11-percent decrease in biomass between 1992 and 1993 due to continued poor recruitment and general less than average year-class strength. However, the abundance of Pacific halibut in the Pribilof Island area is projected to be sufficient to maintain a local commercial fishery at current harvest levels for the foreseeable future, due to relatively low levels of overall exploitation in the EBS. Substantially all of the Pacific

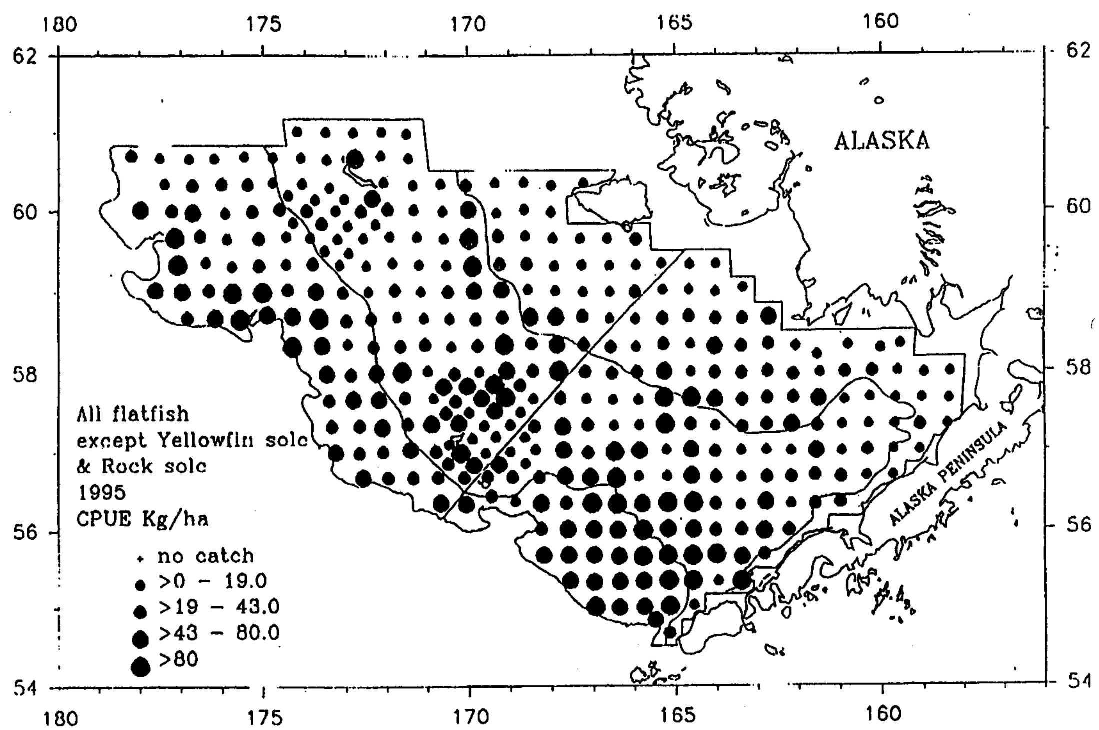


FIGURE B-2.38.--Catch per unit effort (kilograms per hectare) of other flatfish (all except yellowfin and rock sole) found during the 1995 NMFS bottom trawl stock assessment survey in the Eastern Bering Sea.

TABLE B-2.25.--*Biomass, acceptable biological catch, total allowable catch, and actual catch in metric tons for "other flatfish" in the Eastern Bering Sea/ Aleutian Islands, 1977-95*

Year	BIOMASS (1)	OY/ABC (2)	TAC	CATCH
1977	635,900	0	0	53,129
1978	635,900	0	0	70,046
1979	948,400	0	0	74,022
1980	1,002,800	0	90,000	83,721
1981	1,150,800	0	90,000	88,840
1982	1,371,800	0	90,000	75,609
1983	1,415,600	85,000	90,000	78,362
1984	1,560,000	67,500	59,610	58,108
1985	1,350,500	57,500	42,000	55,607
1986	1,575,900	55,000	53,222	69,612
1987	1,678,100	50,900	29,795	39,852
1988	1,877,000	279,500	16,731	90,478
1989	2,091,100	339,900	79,706	33,215
1990	1,925,700	437,500	68,661	37,555
1991	2,279,652	343,100	81,974	51,053
1992	2,019,500	288,900	81,600	49,575
1993	2,022,000	270,000	82,650	46,858
1994	1,924,000	325,400	73,000	54,453
1995	2,177,000	375,000	66,767	0

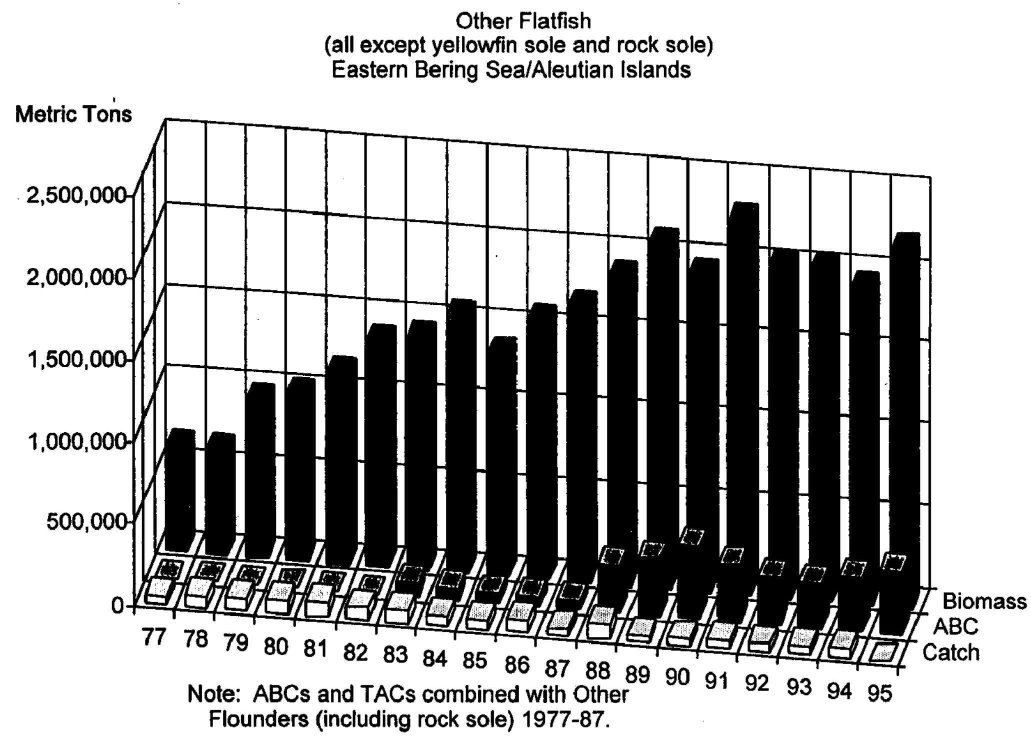
Note 1: Exploitable biomass estimates in 1977 and 1978 based on 1978 trawl survey result

Note 2: OYs (optimum yield) were used in Eastern Bering Sea/Aleutian Island groundfish allocations from 1977 to 1981 and are essentially equivalent to ABCs since 1982.

Source: NMFS.

halibut caught near St. Paul Island by the local small-boat fishery is landed and processed locally.

Harvest and Value. Pacific halibut are taken by target long-line fisheries under a newly initiated individual transferable quota (ITQ) system, in which fishermen are allocated a percentage of the total annual available harvest quota. The Pacific halibut fishery near St. Paul Island is conducted by small-boat long-liners operated from St. Paul Harbor. The fish are landed daily for processing and freezing. Recent harvests in the entire EBS have averaged about 3,800 mt annually and have been worth about $12 million. The harvests are expected to continue at this level for the foreseeable future.



Source: NMFS.

FIGURE B-2.39.--Biomass, acceptable biological catch (ABC), and actual catch of "other flatfish" in the Eastern Bering Sea/Aleutian Islands, 1977-95.

TABLE B-2.26.--*Actual catch in metric tons of "other flatfish" in the Eastern Bering Sea/Aleutian Islands, 1977-94.*

YEAR	EASTERN BERING SEA				ALEUTIAN ISLANDS				COMBINED AREAS			
	TALFF	JVP	DAP	TOTAL	TALFF	JVP	DAP	TOTAL	TALFF	JVP	DAP	TOTAL
1977	48,641	0	0	48,641	4,488	0	0	4,488	53,129	0	0	53,129
1978	63,498	0	0	63,498	6,548	0	0	6,548	70,046	0	0	70,046
1979	61,175	0	0	61,175	12,847	0	0	12,847	74,022	0	0	74,022
1980	75,096	325	0	75,421	8,299	1	0	8,300	83,395	326	0	83,721
1981	80,395	405	0	80,800	8,022	18	0	8,040	88,417	423	0	88,840
1982	66,393	484	0	66,877	8,672	60	0	8,732	75,065	544	0	75,609
1983	67,908	2,586	0	70,494	7,815	53	0	7,868	75,723	2,639	0	78,362
1984	49,471	5,264	0	54,833	3,206	69	0	3,275	52,677	5,333	0	58,108
1985	36,741	18,746	0	55,487	42	61	17	120	36,783	18,807	17	55,607
1986	17,276	49,153	887	67,316	99	85	2,112	2,296	17,375	49,238	2,999	69,612
1987	4,914	24,699	6,280	35,893	0	424	3,535	3,959	4,914	25,123	9,815	39,852
1988	0	76,748	12,128	88,875	0	114	1,489	1,602	0	76,861	13,616	90,478
1989	0	21,146	7,017	28,163	0	0	5,052	5,052	0	21,146	12,069	33,215
1990	0	19,409	13,774	33,184	0	0	4,372	4,372	0	19,409	18,146	37,555
1991	0	0	46,853	46,853	0	0	4,200	4,200	0	0	31,655	51,053
1992	0	0	47,712	47,712	0	0	1,863	1,863	0	0	25,841	49,575
1993	0	0	43,294	43,294	0	0	3,545	3,545	0	0	28,876	46,858
1994	0	0	50,071	50,071	0	0	4,382	4,382	0	0	35,778	54,453

TALFF= Total Allowable Foreign Fishing
JVP= Joint Ventuure Production
DAP= Domestic Annual Production

Source: NMFS.

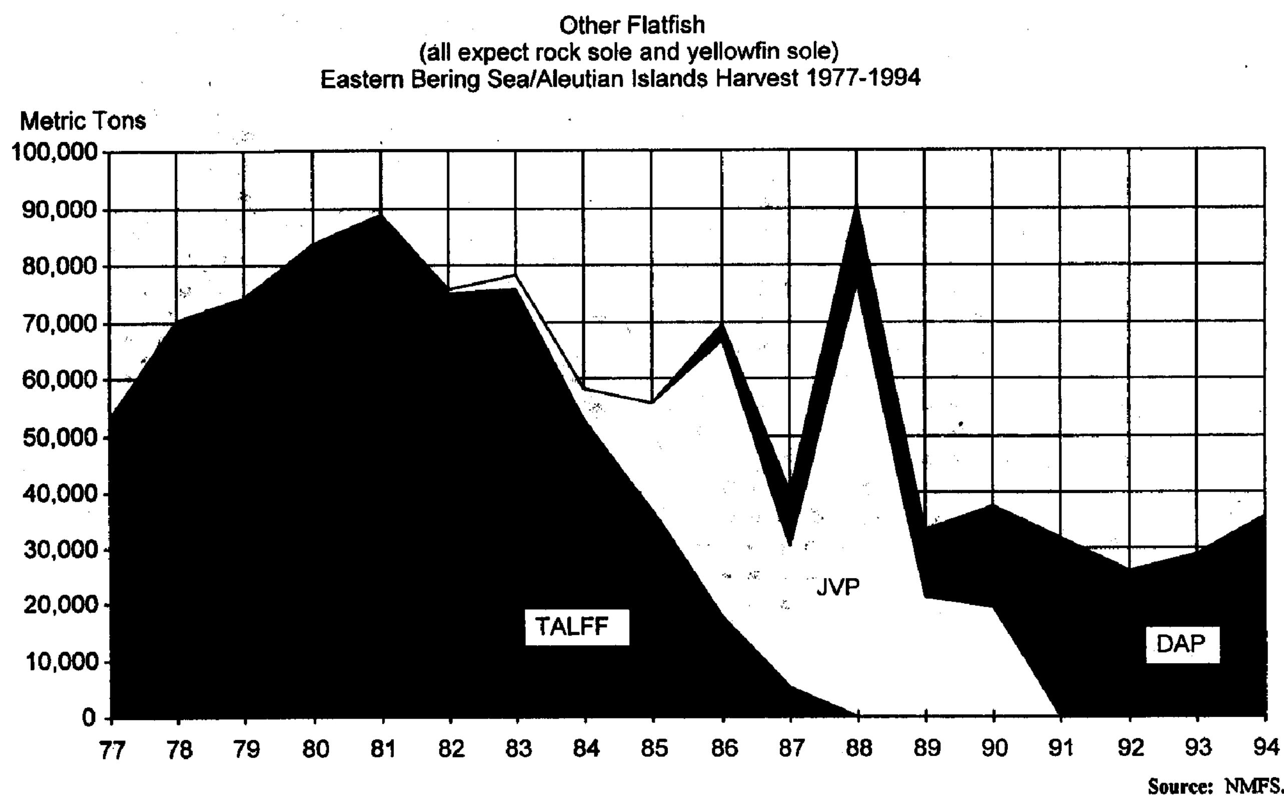


FIGURE B-2.40.--Actual catch of "other flatfish" in the Eastern Bering Sea/Aleutian Islands, 1977-94.

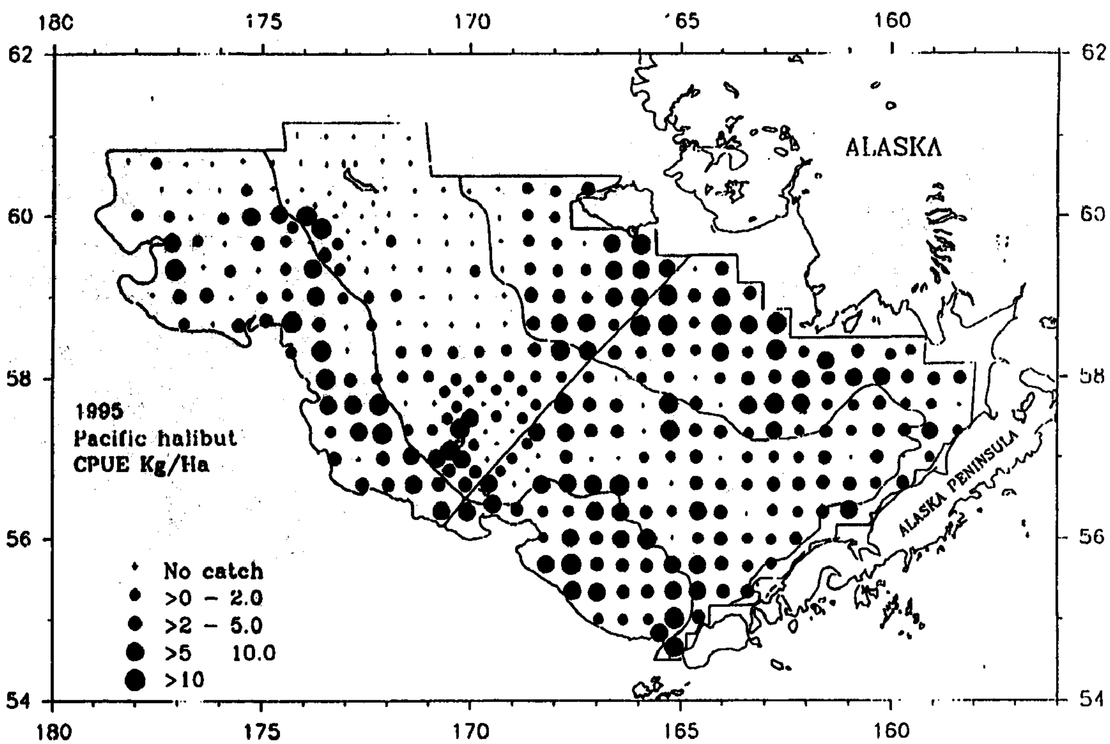


FIGURE B-2.41.--Catch per unit effort (kilograms per hectare) of Pacific halibut found during the 1995 NMFS bottom trawl stock assessment survey in the Eastern Bering Sea.

2.4.11 Snails.

Distribution and Abundance. The species of primary interest to the newly developing snail-pot fishery in the EBS is *Neptunea pribiloffensis*. This species is distributed mainly along the outer continental shelf from the Pribilof Islands north to St. Matthew Island, with the majority of the stock in the vicinity of St. Paul Island (figure B-2.42). Exploitable biomass levels are not available, since the snails are not effectively caught in the NMFS trawl survey conducted each year. However, historical foreign catches in the area and evidence of their distribution in the fledgling commercial fishery indicate that they are relatively abundant and can sustain a small-scale viable fishery. Substantially all of the snails caught near St. Paul Island by the local crab boat fishery are landed and processed locally.

Harvest and Value. Japanese snail catches in the EBS averaged about 12,000 mt of whole live animals per year during the early to mid-1970's and somewhat less through 1987, when the fishery was phased out. In 1994 and 1995, about 1,000 mt of snails were caught in the St. Paul area. Crab vessels fish the snails with small wire pots strung together on a ground line. The snails are landed in St. Paul or Dutch Harbor for processing. Although the potential volume and value of this fishery is unknown, it is believed that at least 5,000 to 10,000 mt of snails could be harvested annually based on historical foreign catches (table B-2.27).

2.4.12 Other Resources.

Other seafood resources harvested in the vicinity of St. Paul Island include Atka mackerel, sablefish, shrimp, squid, sea urchins, sea cucumbers, octopus, and scallops. Of particular interest to St. Paul Harbor is the potential development of a local dive fishery for sea urchins and sea cucumbers, and trap fisheries for octopus. Commercial fisheries for sea urchins, sea cucumbers, and octopus in the Kodiak Island area are valued at nearly $1 million annually to local participants. Although the relative biomass and abundance of these resources is not known, commercial quantities are likely to exist in the St. Paul area, based on incidental bycatch of these resources in other directed fisheries.

2.4.13 Russian Groundfish Resources.

A variety of marine resources are distributed in the Russian Far East (figure B-2.43). The region closest to St. Paul Harbor is the Chukotka District. The Chukotka District lies in the far northern portion of the Western Bering Sea. It has severe Arctic weather dominated by long, cold winters and sea ice that inhibits coastal navigation and fishery operations. Pollock, Pacific cod, Pacific halibut, chinook and coho salmon, and blue, king, and tanner *opilio* and *bairdi* crab are the main resources of the area. Anadyr is the main port in the district, with some minor fishing activity also out of Provideniya. Fishery fleets and infrastructure are poorly developed in the Chukotka District. The main fishing company in the district is A/O Leader in Anadyr, which concentrates on local salmon and in-shore species for local consumption. According

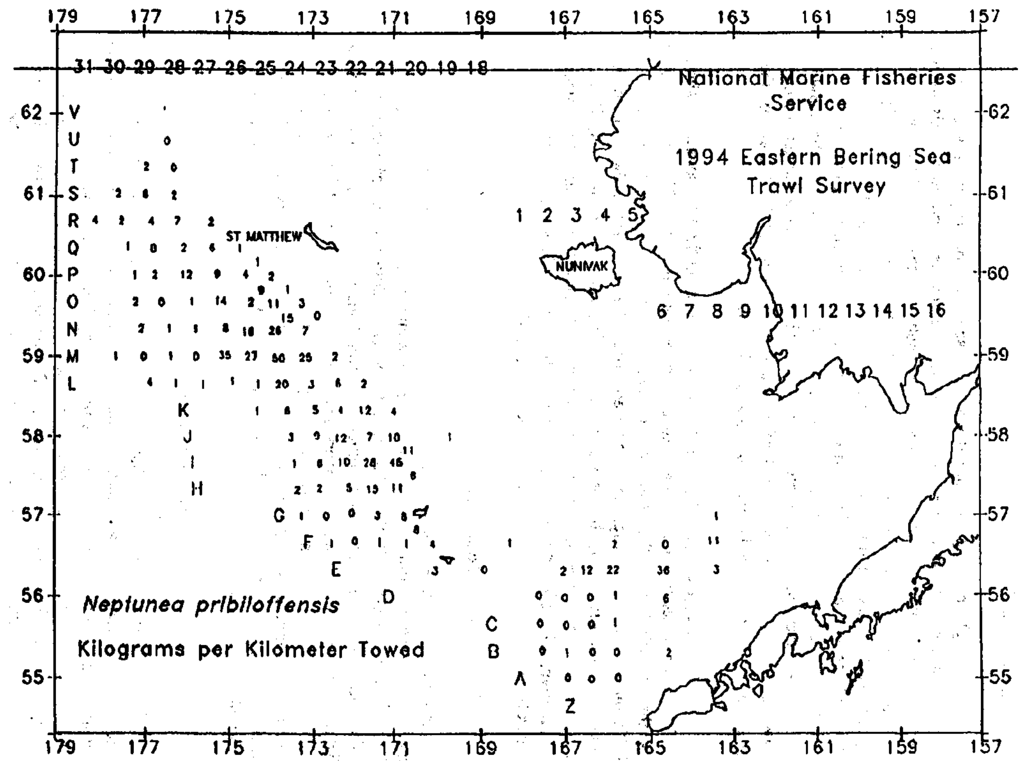


FIGURE B-2.42.--Catch per unit effort (kilograms per kilometer) of Neptunea pribiloffensis *found during the 1994 NMFS bottom trawl stock assessment survey in the Eastern Bering Sea.*

TABLE B-2.27.--*Snail catch statistics from the Japanese fishery in the Eastern Bering Sea, 1972-87*

Year	Effort - Vessel Days	snail catch Whole (mt)	snail catch Meats (mt)
1972		11900	3218
1973		12300	3319
1974		13237	3574
1975		12767	3447
1976		NA	NA
1977	152	1500	404
1978	749	8100	2184
1979			537
1980			57
1981			239
1982			227
1983			326
1984			230
1985			105
1986			493
1987			882
1988	(No fishery after 1987)		

A fishery has existed since at least 1971 but no statistics are available prior to 1972.

1972 through 1978 from MacIntosh, R. A. 1980. The Snail resource of the Eastern Bering Sea and its Fishery. Mar. Fish Rev.

1979 through 1987 from pers. comm. Jerry Berger, NOAA, NMFS F/AKC2, 4/19/91.

Source: NMFS.

to Russian experts, there are no plans by any domestic Russian or foreign joint-venture company to develop shore-based fishing operations in the Chukotka District in the foreseeable future. Unless a viable U.S.-based company, operating from a U.S. harbor can access these resources under a quota purchase or joint-venture arrangement, they are likely to go unharvested for the foreseeable future. The potential quotas from the Russian government for species found in the Western Bering Sea (Chukotka District) include 600,000 mt of pollock, 80,000 mt of Pacific cod, 1,600 mt of blue king crab, 1,750 mt of tanner *opilio* crab, and 1,600 mt of tanner *bairdi* crab (tables B-2.28 through B-2.32).

General Status of Fishery Resources. Information on the status of stocks of marine resources based on actual field surveys or scientific research in the

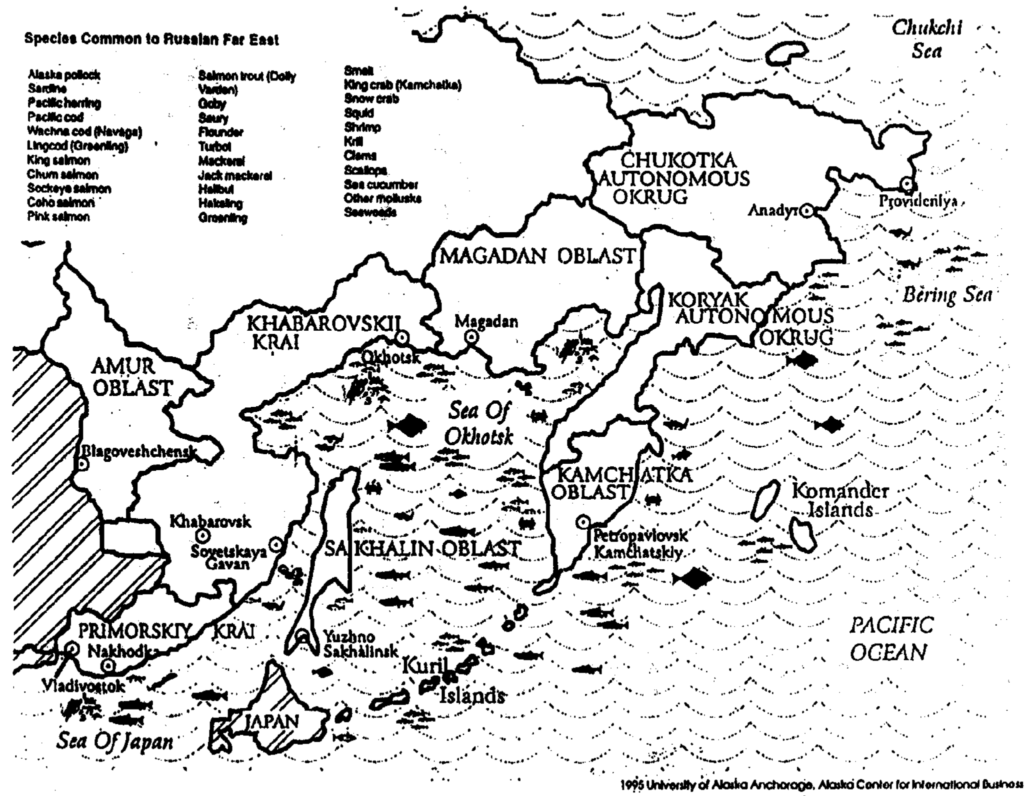


FIGURE B-2.43.--Location of Russian Far East administrative districts and adjacent fishery resources.

TABLE B-2.28.--*Official Russian government projections of allowable harvest quotas for pollock by district, 1995-2015* .

MAP ZONE	AREA	PROJECTED QUOTA (MT) 1995	2000	2005	2010	2015
61.01 W. Bering Sea		500,000	600,000	600,000	600,000	600,000
61.02 E. Kamchatka	Karagin	50,000	200,000	200,000	200,000	200,000
	Petr.-Komandor	95,000	95,000	70,000	70,000	80,000
	Subtotal	145,000	295,000	270,000	270,000	280,000
61.03 N. Kuril		60,000	55,000	30,000	30,000	40,000
61.04 S. Kuril		95,000	100,000	150,000	150,000	150,000
61.05 Sea of Okhotsk	N. Sea of Okhotsk	600,000	400,000	400,000	400,000	400,000
	W. Kamchatka	450,000	400,000	400,000	400,000	400,000
	E. Sakhalin	70,000	90,000	90,000	90,000	90,000
	Kamchatka-Kuril	150,000	150,000	150,000	150,000	150,000
	Subtotal	1,270,000	1,040,000	1,040,000	1,040,000	1,040,000
61.06 Sea of Japan	Primorye	12,000	25,000	20,000	30,000	30,000
	W. Sakhalin	10,000	15,000	15,000	15,000	15,000
	Subtotal	22,000	40,000	35,000	45,000	45,000
Amur & Liman Lk. Hanka, Rasdolnoye		–	–	–	–	–
Total Russian Far East Region		2,092,000	2,130,000	2,125,000	2,135,000	2,155,000

Source: TINRO, February 1995.

Russian Far East is difficult, if not impossible, to obtain. Since the dissolution of the USSR, central government funding of fishery research throughout the Russian Federation has been severely cut. Recent harvest trends, fishing patterns, and the average size of fish and crab offer the best current insight into the health of the Russian Far East marine resources. The total Russian Federation quota has averaged about 10 million mt over the past 5 years, with the Russian Far East quota ranging from 6.0 million mt 5 years ago to about 2.9 million mt in 1995. As indicated in the previous section, harvests of quotas have fallen short for all but the highest-valued species due to lack of infrastructure, fuel, and vessels, and in some cases declines in stock abundance. Based on available information, the overall health of marine resources in the area appears to be good, as is the health of the same resources in the EBS. Exploitation rates appear to be at or near full utilization for red king crab and

TABLE B-2.29.--*Official Russian government projections of allowable harvest quotas for Pacific cod by district, 1995-2015*

MAP ZONE	AREA	PROJECTED QUOTA (MT) 1995	2000	2005	2010	2015
61.01 W. Bering Sea		73,000	80,000	85,000	80,000	80,000
61.02 E. Kamchatka	Karagin	26,000	25,000	30,000	30,000	26,000
	Petr.-Komandor	14,000	14,000	14,000	17,000	17,000
	Subtotal	40,000	39,000	44,000	47,000	43,000
61.03 N. Kuril		11,000	11,000	11,000	13,000	13,000
61.04 S. Kuril		7,000	5,000	5,000	4,500	4,000
61.05 Sea of Okhotsk	N. Sea of Okhotsk	--	--	--	--	--
	W. Kamchatka	50,000	30,000	30,000	30,000	30,000
	E. Sakhalin	--	--	--	--	--
	Kamchatka-Kuril	31,000	31,000	35,000	35,000	30,000
	Subtotal	81,000	61,000	65,000	65,000	60,000
61.06 Sea of Japan	Primorye	4,000	5,000	5,000	5,000	5,000
	W. Sakhalin	6,500	7,000	7,000	7,000	7,000
	Subtotal	10,500	12,000	12,000	12,000	12,000
Amur & Liman Lk. Hanka, Rasdolnoye		--	--	--	--	--
Total Russian Far East Region		222,500	208,000	222,000	221,500	212,000

Source: TINRO, February 1995.

pollock. Other resources are underutilized when compared with historical harvests and estimates of reasonable biomass levels. Only the pilchard resource appears to be in sharp decline, with little, if any, significant production expected from this species in the near future.

<u>Groundfish Resource Abundance</u>. Pollock has been declining in abundance in the Russian Far East as the strong 1989 year-class begins to exit the fishery due to old age, and recent year-classes show less than average strength. The Russian Far East pollock biomass is estimated to be somewhere between 10 million mt and 14 million mt. Recent harvests have resulted in an exploitation rate of between 14 percent and 20 percent, consistent with recent exploitation rates in U.S. fisheries and not believed to reduce the maximum sustainable yield of the resource. The

TABLE B-2.30.—*Official Russian government projections of allowable harvest quotas for blue king crab by district, 1995-2015*

MAP ZONE	AREA	PROJECTED QUOTA (MT) 1995	2000	2005	2010	2015
61.01 W. Bering Sea		1,600	1,600	1,600	1,600	1,600
61.02 E. Kamchatka	Karagin	–	–	–	–	–
	Petr.-Komandor	100	100	100	100	100
	Subtotal	100	100	100	100	100
61.03 N. Kuril		150	100	100	100	100
61.04 S. Kuril		–	150	150	150	150
61.05 Sea of Okhotsk	N. Sea of Okhotsk	350	300	300	300	300
	W. Kamchatka	1,500	1,500	1,500	1,500	1,500
	E. Sakhalin	150	150	150	150	150
	Kamchatka-Kuril	–	–	–	–	–
	Subtotal	2,000	1,950	1,950	1,950	1,950
61.06 Sea of Japan	Primorye	450	400	400	400	400
	W. Sakhalin	150	150	150	150	150
	Subtotal	600	550	550	550	550
Amur & Liman Lk. Hanka, Rasdolnoye		–	–	–	–	–
Total Russian Far East Region		4,450	4,450	4,450	4,450	4,450

Source: TINRO, February 1995.

average size of pollock in the commercial harvest has declined by about 16 percent over the past 5 years. This is likely due to a greater percentage of fish from younger age classes being represented in the harvest, not poor growth conditions. Since size and age data are not available for recent years, it is difficult to judge ocean conditions that might be influencing pollock abundance. However, similar percentage declines in pollock abundance noted off Alaska in the EBS are attributed to recent below-average year-class strength caused by less than optimal ocean survival. The gradual decline in North Pacific Alaska pollock abundance is not presently of concern. The agreement between Russia and foreign countries halting unregulated pollock fishing in the international waters known as the "doughnut hole" is an important factor. This agreement must be continued to assure that Russian pollock stocks are not overutilized.

TABLE B-2.31.—*Official Russian government projections of allowable harvest quotas for tanner* opilio *crab by district, 1995-2015*

MAP ZONE	AREA	PROJECTED QUOTA (MT) 1995	2000	2005	2010	2015
61.01 W. Bering Sea		1,750	1,750	1,750	1,750	1,750
61.02 E. Kamchatka	Karagin	250	200	200	200	200
	Petr.-Komandor	–	–	–	–	–
	Subtotal	250	200	200	200	200
61.03 N. Kuril		–	300	300	300	300
61.04 S. Kuril		–	–	–	–	–
61.05 Sea of Okhotsk	N. Sea of Okhotsk	2,600	2,600	2,600	2,600	2,600
	W. Kamchatka	–	–	–	–	–
	E. Sakhalin	5,000	4,700	4,700	4,700	4,700
	Kamchatka-Kuril	–	–	–	–	–
	Subtotal	7,600	7,300	7,300	7,300	7,300
61.06 Sea of Japan	Primorye	1,200	1,200	1,200	1,200	1,200
	W. Sakhalin	1,000	1,000	1,000	1,000	1,000
	Subtotal	2,200	2,200	2,200	2,200	2,200
Amur & Liman Lk. Hanka, Rasdolnoye		–	–	–	–	–
Total Russian Far East Region		11,800	11,750	11,750	11,750	11,750

Source: TINRO, February 1995.

Based on recent reports of high catch rates, Pacific cod appear to be at above average abundance in the Russian Far East, although current biomass estimates are not available. In the late 1980's, Russian scientists estimated that Pacific cod biomass in the Russian Far East was more than 1.5 million mt. Recently, Pacific cod abundance in the EBS has also shown an increase, with markedly higher catch rates. Recent harvests are relatively low compared with the expected stock abundance, due mainly to lack of fishing effort. Pacific cod abundance in U.S. waters off Alaska has declined gradually as average or below average year-classes have replaced more abundant year-classes. In the United States, several recent year-classes of cod appear to be well above average and are now entering the fishery. It is quite possible that similar beneficial environmental conditions exist in the Russian Far East, and cod year-classes

TABLE B-2.32.—*Official Russian government projections of allowable harvest quotas for tanner* bairdi *crab by district, 1995-2015*

MAP ZONE	AREA	PROJECTED QUOTA (MT) 1995	2000	2005	2010	2015
61.01 W. Bering Sea		1,600	1,600	1,600	1,600	1,600
61.02 E. Kamchatka	Karagin	250	200	250	250	250
	Petr.-Komandor	–	–	–	–	–
	Subtotal	250	200	250	250	250
61.03 N. Kuril		300	300	300	300	300
61.04 S. Kuril		–	–	–	–	–
61.05 Sea of Okhotsk	N. Sea of Okhotsk	–	–	–	–	–
	W. Kamchatka	–	–	–	–	–
	E. Sakhalin	–	–	–	–	–
	Kamchatka-Kuril	1,500	1,500	1,500	1,500	1,500
	Subtotal	1,500	1,500	1,500	1,500	1,500
61.06 Sea of Japan	Primorye	–	–	–	–	–
	W. Sakhalin	–	–	–	–	–
	Subtotal	–	–	–	–	–
Amur & Liman Lk. Hanka, Rasdolnoye		–	–	–	–	–
Total Russian Far East Region		3,650	3,600	3,650	3,650	3,650

Source: TINRO, February 1995.

in those areas may be stronger than those 4 to 5 years ago. If so, similar increases in abundance of Pacific cod in the Russian Far East should be observed.

The status of stocks of other groundfish resources in the Russian Far East is not well understood. Recent harvest patterns indicate these resources are probably being exploited at levels well below their maximum sustainable yield, with the possible exception of halibut and rockfish. These species are long-lived, of high demand and value, and slow to increase or decrease in abundance naturally. The other groundfish resources of the Russian Far East probably can sustain higher harvest rates as long as problems of bycatch of fully exploited species, such as crab and pollock, can be addressed in management actions.

3. EXISTING HARBOR CONDITIONS

The existing harbor at St. Paul, completed in 1990, consists of a main breakwater 1,800 feet long, a detached breakwater 970 feet long, and space for 900 feet of docks on the lee side of the main breakwater. The city has 200 feet of concrete caisson dock, 100 feet of steel pile dock, and the ship *Unisea*, which is moored on the back side of the main breakwater. Tanadgusix Inc., the Native corporation, also has a 200-foot dock.

Natural Resources Consultants, Inc., (NRC) conducted an independent evaluation of the operating conditions at the St. Paul harbor. In early 1995, the firm interviewed key personnel involved with the operation of the harbor, including the harbormaster, representatives of the three processors, city of St. Paul personnel, and operators and owners of crab catcher and catcher/processor vessels. Additional information was provided by experts on Russian Far East marine resources and joint-venture business enterprises, the U.S. Weather Service, the ADF&G, the U.S. Coast Guard, and NRC itself.

The NRC evaluation identified many problems encountered at St. Paul Harbor. These are the three primary problems:

- The entrance channel and maneuvering basin are not adequate for vessel navigation.
- Overtopping of the breakwater during storms creates unsafe conditions in the harbor and damages equipment and vessels.
- Sway created by overtopping and by wave energy transmitted through the breakwater damages vessels rafted together by parting moorage lines, breaking dock and vessel moorage cleats, and destroying bumpers.

In addition, inadequate dock space, lack of waterfront land for building construction and storage, overtopping damage to the road (which causes material to be deposited under the floating processor), and overall crowding are identified as problem areas.

The St. Paul harbor was constructed to serve a fishing fleet of 65 vessels. Processing plants, either floating or shore-based, were not considered in the design. Harbor depths were designed to accommodate unladen fishing vessels which would go into the harbor to refuel and stock provisions. It was assumed that floating processors would stay outside the harbor and on the lee side of St. Paul Island during storms.

By contrast, the harbor currently serves a fleet of approximately 230 transient vessels during the crabbing season. According to the mayor, 27 floating processors operated within the 3-mile limit in 1994. St. Paul is in a rapid growth cycle, and well-established seafood processors are investing capital to relocate and build processing plants in the area. These processors include Trident, Icicle Seafood, and Unisea. Unisea moved a floating crab processing plant from Dutch Harbor to the city dock, and Icicle has moored a processor to the Tanadgusix, Inc., dock. In the harbor is the Trident shore processor with one onshore plant. Fishing boats operating out of St. Paul are for the most part equipped with pots or long-line gear. The new Trident plant is capable of processing halibut, cod, and pollock in addition to crab, opening the possibility of expanding fisheries processing in the area.

The weather sharply constrains the number of days the St. Paul harbor can operate, and makes it all the more important for the harbor to be able to operate at capacity on the remaining days. Table B-3.1 shows the number and length of harbor closures due to inclement weather in 1994/95. Figure B-3.1 shows the monthly frequency of inclement weather closures during the same time period. Figure B-3.2 shows the harbor closures that occurred during the 1994 crab seasons.

TABLE B-3.1.--*Closures of St. Paul Harbor due to inclement weather, 1994/95*

1994 Month	Frequency of Closures due to inclement weather	Days of month closed due to inclement weather
JUN	0	-
JUL	0	-
AUG	1	10
SEP	0	-
OCT	4	1,6,22,31
NOV	17	2,3,5,6,7,8,9,10,11,12,14,15,22,25,26,27
DEC	11	2,3,7,9,10,11,12,28,29,30,31
JAN	4	3,4,21,22
FEB	3	4,5,6
MAR	2	29,30
APR	0	-
MAY	0	-
Total	42	

Source: St. Paul harbormaster's logs.

3.1 Entrance Channel and Maneuvering Basin

Currently, the size and depth of the navigation channel and turning basin require processors to haul in equipment and supplies and haul out finished product using tugs

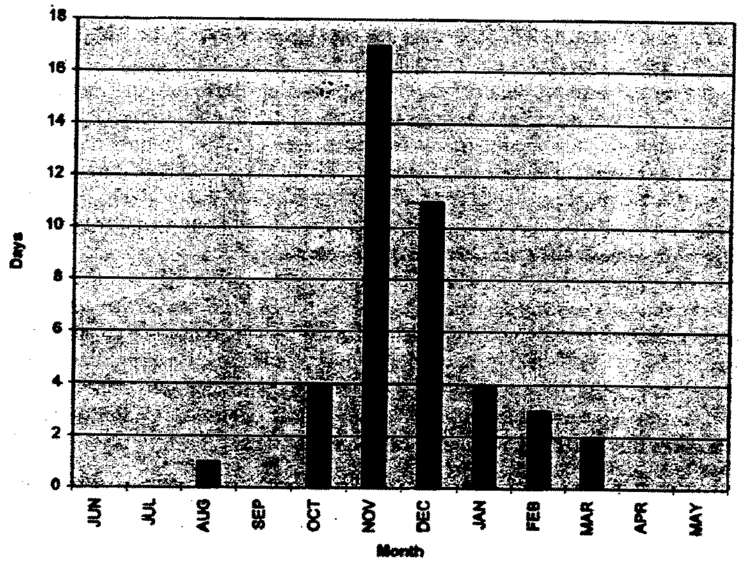
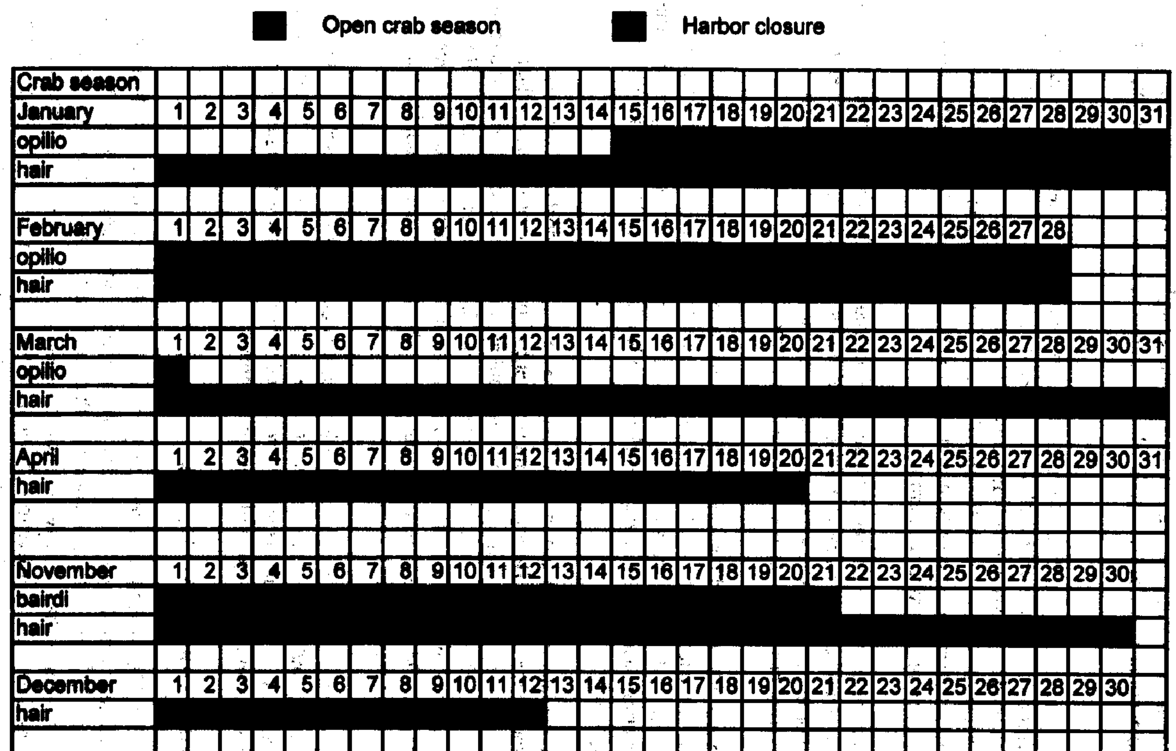


FIGURE 3.1.–Monthly frequency of inclement weather closures for St. Paul Harbor, 1994/95.

and barges. When a barge is brought in for loading or offloading, all of the catcher vessels in the harbor must first exit because of the lack of maneuvering space. This causes delays in offloading, fueling, and reprovisioning vessels, and can create unsafe situations during poor weather conditions. Catcher vessel operators must move their vessels frequently to make room for other vessels entering or exiting the port.

Inadequate anchorage within the harbor requires vessels to raft together at the dock, increasing damages and affecting the efficiency of overall operations. Vessels face difficulties in transiting the navigation channel and unsafe conditions entering and leaving the harbor. Some of the larger cargo vessels must back into the harbor due to lack of a turning basin. This method of operation is unsafe and inefficient. Catcher vessels have been damaged after running aground, and several barges have gone aground in the basin.

St. Paul has only one fuel dock, and delays up to several hours occur when several vessels are in the harbor for refueling. During the 3-month crabbing season, the fuel dock is closed at least once each week for a minimum of 3 hours when cargo vessels deliver supplies to the harbor. These shutdowns are in addition to the harbor closures



Source: Alaska Dept. of Fish & Game, City of St. Paul Harbormaster Logs, NRC.

Figure B-3.2. --Overlap of 1994 crab seasons and St. Paul Harbor closures due to inclement weather.

due to weather. Because of the lack of a maneuvering basin, vessels are forced to move to accommodate larger vessels when the harbor is crowded or large ships are in port.

Limited space makes it difficult for vessels to enter and depart the harbor, resulting in significant delays. An example of this occurred on January 12, 1993, when the M/V *Shellfish* tried to depart but crowded conditions prevented the vessel from swinging out from the dock. Eventually the *Shellfish* had to back out after waiting more than an hour. At other times, vessels must move around to make room for boats moving to another dock or departing the harbor.

Representatives of the shipping company SunMar reported that the harbor is too small for their cargo vessel, the *SunMar Sky* (256 by 43 by 16 ft laden), which has entered the harbor in the past. The vessel must back into the harbor due to lack of a maneuvering basin, an unsafe and inconvenient procedure.

Icicle Seafoods reported that one of their catcher vessels, the *Centaurus*, went aground while leaving the floating processor *Arctic Star* during 1994, resulting in loss of the rudder. Several barges that frequent St. Paul Harbor have gone aground in the maneuvering basin. The *Baranof Trader* grounded twice in 1994, though no damage was reported.

Due to the lack of room and shallow draft at St. Paul, large boats and processors operating in the eastern Bering Sea must travel to Dutch Harbor to deliver their catches. The existing conditions at the St. Paul harbor force vessel operators to travel there to unload, even though the distance from the fishing grounds is farther. If the harbor at St. Paul had a larger maneuvering basin and a deeper channel, most vessel operators would choose to unload product at St. Paul rather than Dutch Harbor to save fuel and travel time.

A large number of accidents in the Bering Sea are reported to the Coast Guard during the crabbing and fishing seasons. Most of the injured are taken to the St. Paul Clinic for treatment. Vessels in the harbor are forced to move to allow the entrance of a vessel in distress or dropping off injured fishermen.

3.2 Breakwater Overtopping

The St. Paul breakwater was designed to have minimal overtopping. The final design included large cap stone to significantly reduce the overtopping. Observations from 1989 through 1995 and discussions with the harbormaster indicate that substantially more overtopping has occurred than the breakwater was designed for. Green water overtops the breakwater five to eight times per year, on average. Wind-driven spray overtops the breakwater 8 to 15 times per year. The space leeward of the breakwater is needed for harbor efficiency and expansion. Therefore, the overtopping must be reduced.

Overtopping of the breakwater occurs when sustained winds from the south or southwest in excess of 20 knots cause large seas to break on and over the main breakwater. Its effect on harbor operations can range from a minor inconvenience due to salt-water spray on the dock and in the harbor to very unsafe conditions when large amounts of seawater and debris are deposited onto the road and dock. Overtopping is responsible for a significant amount of damage and expense to public and private property in St. Paul Harbor, including road washouts; damage to vessels, docks, and processing barges; salt-water spray damage to electrical panels, exteriors of buildings, and rolling equipment; and cleanup of debris cast over the breakwater.

This overtopping of the breakwater also creates wave action in the harbor, which damages rafted vessels by parting moorage lines, breaking dock and vessel moorage cleats, and destroying bumpers. Operators of several crab catcher vessels (F/V *Ocean Cape*, F/V *Aleutian No. 1*, F/V *Entrance Point*, and F/V *Zolotoi*) reported dangerous conditions between the main breakwater and the detached breakwater when entering the harbor under overtopping conditions. Waves created during overtopping tend to push the vessels toward the detached breakwater. To allow for this effect, vessels must transit closer to the main breakwater than is generally safe. At times, they are still pushed dangerously close to the detached breakwater.

4. WITHOUT-PROJECT CONDITION

Without improvements to the St. Paul entrance channel, maneuvering basin, and main breakwater, conditions will remain the same or worsen over time. Vessels will continue to sustain damages, lose catch due to delays and diversions, endure excessive moving when large vessels enter the harbor, and travel to Dutch Harbor at additional cost to unload catch. Processors will continue to ship finished product to Dutch Harbor for loading, and the potential for additional crab harvest in Russian waters will not materialize.

5. WITH-PROJECT CONDITION

With the proposed project, the entrance channel would be deepened and widened, and the maneuvering basin would be deepened and enlarged. Also, overtopping and wave energy transmitted through the breakwater would be greatly reduced. These improvements would reduce congestion and allow typical tramper freighters to enter the harbor.

5.1 Benefits of Proposed Project

Primary benefit categories resulting from the proposed improvements include reduction in direct damage losses due to overtopping, and increased efficiencies related to crab processing, reduced crab deadloss, and reduction in vessel damage. The benefits of navigation improvements at St. Paul are discussed by category in the following paragraphs.

5.1.1 Prevention of Damage from Breakwater Overtopping.

Unisea reported that overtopping and sway created by wave energy transmitted through the breakwater have resulted in damages exceeding $500,000 per year to its floating processor over the past 2 years. These costs include replacement of damaged bumpers, damage to ramps and stairs onto vessels, broken mooring chain and rope, damage to the port side of the Unisea plant catwalk, destruction of four "Yokohama" bumper systems, replacement of electrical systems and rolling equipment due to salt-water contamination, removing road washout material from under the ship, and labor to clean up debris left by overtopping. In addition, the overtopping poses a high risk of injury or death to workers.

Unisea will continue to experience major damages to its floating processor and mooring facilities until overtopping is prevented or the barge is relocated. Based on the short history of the plant at St. Paul, and given the dearth of alternative locations for the processor, it is reasonable to assume Unisea will continue to accept the damages.

The harbor road is damaged by overtopping about 15 times each year. Other facilities have been damaged as well, including fire hydrants, a phone shack, electrical panels on the harbormaster's office, bitts along the dock, and dock bull rails. All these damaged items require regular repair and replacement, at an estimated annual cost of $25,000.

The proposed improvements to the main breakwater are expected to eliminate damages from sway and overtopping. Total average annual benefits are estimated to be $525,000.

5.1.2 Savings in Transportation of Processed Seafood

The movement of goods in national and international trade is multidimensional. A port represents just one of the links in this chain of commerce connecting materials to markets around the world. Actions by the port invoke responses in other elements of the chain. Likewise, changes in other components of national and international trade influence the ability of the port to participate cost-effectively in the expeditious movement of cargo from origin to destination.

The economic efficacy of proposed modifications to St. Paul Harbor cannot be properly evaluated without recognizing the interconnectedness of cargo transport and understanding how current trends in cargo transport will affect the future competitive position of the port. One of the most important of these trends concerns economies of scale as they affect cargo transportation.

Obvious economies of scale are driving carriers to ever larger vessel sizes. In general, the more materials a given cargo vessel can carry on any given transit between two ports, the more net profit that carrier can enjoy. A vessel that has 3.5 times the cargo capacity of another has only double the daily fixed costs.[1] This trend toward larger cargo vessels is particularly relevant to St. Paul. Being phased into service over the next 5 years are vessels in the 300- to 350-ft Length Overall (LOA), 150,000-cubic foot (ft^3) and larger cargo classes.[2] Similar trends are evident in the small container vessel fleet. Clearly, the size threshold for the majority of carriers serving ports like St. Paul is moving upward to the 300- to 350-ft-LOA level. Ports seeking to be involved in trade in a cost-effective manner must be able to deliver goods to this emerging class of vessels.

Unfortunately, vessels in the +300-ft class will be unable to service the Port of St. Paul as it is presently defined. The current harbor entrance channel is too narrow and shallow and the maneuvering basin too confined for vessels in this size range. Furthermore, pilotage is mandated for vessels operating within 3 miles of St. Paul Harbor. Given the existing characteristics of the port, marine pilots indicate that they do <u>not</u> bring vessels larger than 200 to 225 ft LOA into St. Paul Harbor except under emergency conditions or very special circumstances.[3] Without harbor improvements, the Port of St. Paul will find itself precluded from servicing this emerging class of +300-ft- LOA cargo vessels.

<u>Processed Seafood Production from St. Paul</u>. Crab is the primary seafood resource harvested, delivered, processed, and shipped out of the Port of St. Paul. Of the four species of crab processed and transported out of St. Paul, *C. opilio* represents the largest quantity of cargo. In 1994, 12.8 million pounds of

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[1] American President Lines, 1995.

[2] Typical dimensions of a 150,000-ft^3 tramper are 301 by 53 ft with a draft of 22 ft. Personal communication, Vince Addington, Alaska Maritime Agencies.

[3] Personal communication, Dave Sanders, vice president, Alaska Marine Pilots Association.

processed crab were shipped from St. Paul Harbor. Significant increases in the *C. opilio* stock are projected by Bering Sea crab resource biologists in the next few years. These resource increases will raise the total quantity of processed *C. opilio* shipped from St. Paul to more than 26 million pounds annually (table B-5.1).

TABLE B-5.1.--*Pounds of processed* C. opilio *expected to be shipped from St. Paul, 1998-2000, U.S. harvests only*

Year	Processed *C. opilio* (lb)
1998	26,627,583
1999	29,290,341
2000	26,361,307

An additional 1.5 million pounds of processed *C. opilio* crab originates from Russian waters and is transshipped in St. Paul. Other species of processed crab shipped from St. Paul Island include *C. bairdi*, Korean horsehair, and king crab. The 1994 processed weight of these species is presented in table B-5.2.

TABLE B-5.2.--*Pounds of processed crab other than* C. opilio *shipped from St. Paul in 1994*

Species	Processed crab (lb)
C. bairdi from U.S.	279,139
Korean horsehair	643,364
King crab	186,403

Small amounts of halibut (325,278 pounds in 1994) and snails (504,000 pounds in 1994) are also shipped from St. Paul following processing.

Modes of Cargo Movement Out of St. Paul. The present St. Paul Harbor was designed in the late 1980's to support a fishing fleet one-third the size of the current operating fleet. Because all processing facilities were then outside the harbor, the harbor was intended only to accommodate unladen fishing vessels going into the harbor to refuel and stock provisions.

Significant amounts of processing have moved inside the harbor since the harbor was completed. Unisea moved a floating crab processing plant from Dutch Harbor to the city dock; Icicle Seafoods has moored a processor to the local Native corporation dock; and Trident has constructed an onshore processing plant capable of processing crab, pollock, halibut and cod (USACE 1995). These changes mandate that cargo vessels enter the harbor to load large amounts of processed product, a condition that escalates congestion in a harbor already overtaxed by the refueling and stocking requirements of a fishing fleet three times larger than that for which the harbor was designed. Because resource managers suggest that resource abundance will increase substantially in the next several years, onshore production and harbor congestion problems will only get worse within the existing harbor configuration.

Currently, seafood products processed in the harbor are carried out of the harbor on barges, small domestic break-bulk carriers[4], and one small container vessel.[5] Barges will continue to be able to use the harbor in the future but are an expensive means of moving cargo. The pool of break-bulk carriers able to access the port will constrict as economic efficiencies associated with vessel size replace smaller vessels with larger ones in this fleet. This pattern has already run much of its course in the container and foreign tramper fleets. Only one container vessel remains in the region that can reliably go into the existing harbor and load containers. Foreign tramper vessels, the least expensive means of moving cargo to Japan or other foreign ports which receive the vast majority of seafood products shipped from St. Paul, are excluded entirely from dockside cargo transfers in St. Paul because of their size and physical characteristics.

All seafood cargo moves from St. Paul to Dutch Harbor before transshipment, primarily to Japan.[6] Design changes to the port are unlikely to change this pathway, for three primary reasons:

a. Vessels departing St. Paul will seek to take advantage of the Great Circle route when traveling to Japan or the United States. A Great Circle route is the closest distance between two points on a globe. Because of the location of the Great Circle route (figure B-5.1), Dutch Harbor will continue to be a convenient and expeditious waypoint for vessels departing from St. Paul.

b. Dutch Harbor is a deep-water port where large (+600-ft) container vessels can dock and receive transshipments of cargo from smaller feeder vessels servicing outlying ports such as St. Paul.

c. Lastly, all goods entering or leaving the United States through Western Alaska clear U.S. customs in Dutch Harbor, where the cost of retaining a customs office is distributed among the many carriers servicing the port. While goods could clear customs in St. Paul, this would require stationing a customs office in St. Paul, with its costs covered only by carriers servicing that port. This is an additional expense that carriers appear not to want, given the other advantages offered

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[4] Break-bulk carriers are vessels wherein cargo is loaded "loose." Cargo is moved from dockside into the vessel cargo hold on pallets, where stevedores remove the cargo from the pallets and stow it.
[5] *Northland Sea Trader*, 220 ft LOA.
[6] Small amounts of some seafood products also move to U.S. markets. This total represents less than 5 percent of aggregate seafood shipments from St. Paul.

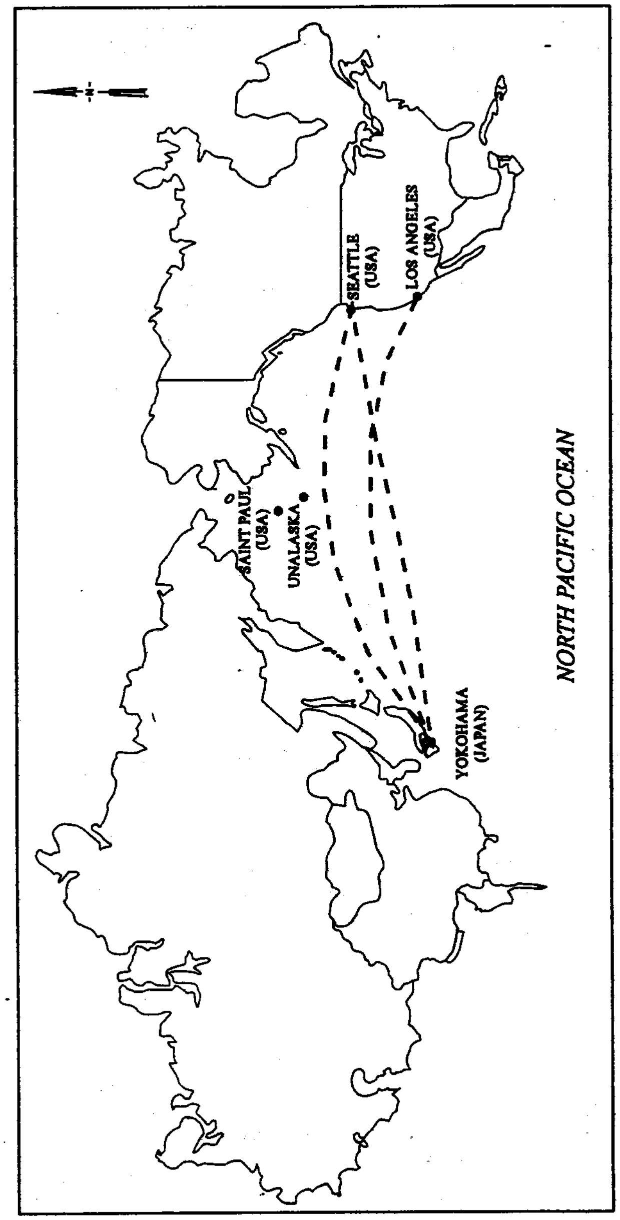

Figure B-5.1. -- Location of Great Circle routes between United States and Japan.

by Dutch Harbor (*i.e.*, proximity to the Great Circle route and access to large container vessels.)[7]

Costs of Cargo Shipment Out of St. Paul. In evaluating the costs of moving cargo out of St. Paul under without- and with-project scenarios, several assumptions were used:

- Cargo is principally crab. Small amounts (5 percent of total seafood out of St. Paul) of halibut and snails are also assumed to be moved through St. Paul.

- Crab has a stowage factor of 130 ft^3 per short ton. Other species are stowed at 85 ft^3 per short ton.

- All cargo passes from St. Paul through Dutch Harbor to its ultimate destination.

- The ultimate destination of crab and snail cargo is Yokohama, Japan. Halibut, less than 1 percent of St. Paul's annual seafood harvest, moves to U.S. domestic markets, with the Port of Seattle used as the point of entry into the lower 48 States.

- When containers are involved in an analysis, containers with a capacity of 2,383 ft^3 per container are used. All containers leaving St. Paul are assumed to be full.

Without-Project Condition. Without improvements to the St. Paul harbor, the harbor will continue to be inaccessible to vessels larger than 200 to 225 ft LOA. Even the smaller container vessels are seldom less than 300 ft LOA. The trend in the container and domestic break-bulk fleet is toward larger vessels to take advantage of economies of scale in cargo transportation. Foreign trampers are already physically unable to take advantage of the harbor at St. Paul. Consequently, barges will likely be the predominant means of moving cargo off St. Paul in the absence of a project.

As stated previously, all seafood cargo from St. Paul moves to Dutch Harbor before transshipment, primarily to Japan. In this analysis, the cost of transporting each ton of processed seafood to Japan from St. Paul under present conditions is derived. The analysis deals with crab cargo bound for Japan, as this makes up more than 90 percent of the St. Paul output.

At present, a barge delivers empty refrigerated cargo vans from Dutch Harbor to St. Paul at the beginning of each year's crab season. During the season, the barge makes several trips to St. Paul to pick up vans full of seafood and return them to Dutch Harbor, where they are offloaded and reloaded onto a large (676-foot) container vessel for shipment to Japan.

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[7] Personal communication, Vince Addington, Alaska Maritime Agencies. November 10, 1995.

St. Paul Island seafood processors use refrigerated containers both for shipping cargo and as their primary source of cold storage on the island. The processing facilities have limited cold storage, so they prefer to store product directly into refrigerated containers. In this discussion, the term "vans" is used for convenience when referring to these containers, though technically the term applies only while the containers are sitting on a truck trailer.

Northland Services, a barge company, keeps at least 100 of these self-refrigerated vans empty on St. Paul at all times during the crab season in case poor weather conditions prevent the company's barges from reaching the harbor. Before the start of the crab season each year, 100 to 150 vans are transported to St. Paul Island from Dutch Harbor. (For this analysis, 120 vans is used. The barge can carry 60 vans, so two trips are needed.) Each van measures 40 by 8 by 9 feet. Until they are needed to serve as cargo vans, they are used as storage containers for processed seafood.

The empty vans are loaded onto the barge at Dutch Harbor with a gantry crane at a rate of 15 vans per hour. Sturdy equipment and experienced crews allow this rate to be achieved even during inclement weather. A single loading crew and crane cost $1,685 per hour. This is the straight-time rate for a minimum 6-hour day with no overtime charges. A wharfage fee of $4.00 per ton and a dock fee of $1.70 per foot are charged at Dutch Harbor.

According to Northland Services, a typical barge serving St. Paul measures 250 by 70 by 12 feet. The tug that tows it is typically a 128-foot, 4,000 horsepower (hp) twin screw vessel with a crew of five. The hourly operating cost of the tug and barge is $466 at sea and $382 in-port. The barge travels the 239 nautical miles to St. Paul at 6.5 knots, taking 36.8 hours to make the trip. At St. Paul, the vans are unloaded with forklifts and moved to a staging area by truck. It takes 10 minutes to unload each van and another 10 minutes to transfer it to the staging area.

The following description of the loading and unloading procedure was provided by TDX. A ramp connecting the dock and barge is attached after the barge is secured to the dock. A forklift on the barge moves vans to the top of the ramp. Another forklift drives up the ramp and transfers the van to a truck and trailer. Vans are transferred to the truck at a rate of six per hour. A single crew with two forklifts costs $325 per hour. This is the straight-time rate, with no overtime charges. The vans are transported by truck to the staging grounds, located one-half mile southeast of the loading dock adjacent to the TDX processing facility.

At the staging area, the vans are removed from the trailer with a forklift and stacked four high. On average, six vans per hour are relocated to the staging area by a crew of five, using two tractor trailers and a forklift. The cost of unloading, including the crew and equipment, is $244 per hour.

The barge is in port at St. Paul for 16 hours: 3 hours to dock and prepare to unload, 10 hours to unload the vans, and 3 hours to prepare to depart and undock. Wharfage and dock fees are the same as at Dutch Harbor, \$4.00 per ton for wharfage and \$1.70 per foot for docking. The barge returns empty to Dutch Harbor. The cost of moving 120 empty vans to St. Paul each season is \$124,000 (rounded). This cost is derived in table B-5.3.

TABLE B-5.3.--*Derivation of cost to move 120 empty vans to St. Paul from Dutch Harbor (DH) at start of crab season*

Line #	Item	Amount
1	Load 60 vans at DH via gantry crane (15 vans/hour)	
2	Crew = \$1,000/hour min. Crane = \$685/hour min.	
3	Total loading cost at DH (6 hours to load)	\$10,110
4	Wharfage (\$4/ton × van weight, 5 tons)	1,200
5	Dock fee (\$1.70/ft) - use 250 ft	425
6	Barge costs in port (\$382/hour)	
	4 hours to load & 2 hours to dock = 6 hours	2,292
7	Barge transportation cost from DH to St. Paul	
	239 nmi ÷ 6.5 knots × at-sea cost of \$466/hour	17,149
8	Unload empty vans (10 hours @ \$324.82/hour)	3,248
9	Move empty vans to staging area (\$244/hour × 10 hours)	2,440
10	Barge cost in port (16 hours × \$382/hour)	6,112
11	Wharfage at St. Paul (\$4/ton × 5 tons/van × 60 vans/trip	1,200
12	Dock fee at St. Paul	425
13	Barge returns to DH empty (36.8 hours × \$466/hour)	17,149
	Total cost to move 60 vans to St. Paul	\$61,750
	Cost to move 120 vans	**\$123,500**

The vans are transported from the staging area and loaded with finished crab--processed and boxed--at the shore-based processors and then returned to the central staging area for storage. They are transferred to the dock when enough vans have accumulated for a shipment to Dutch Harbor. The three St. Paul shore-based processors coordinate the shipment of finished product and arrange for the barge visits to the port. The timing of these visits and of the ensuing seafood shipments depends primarily on when the large container vessel arrives at Dutch Harbor. Shipping companies want these large ships to be full when they begin their long voyage from the Aleutian port. Typically barge deliveries are made out of St. Paul at intervals of about 7 to 10 days during the crab season, primarily to mesh with container vessel schedules at Dutch Harbor. The container vessel exchanges empty containers for full ones, and the barge returns the fresh empties to St. Paul. According to owners of the tug/barge combination serving St. Paul, shipments during the 1996 season usually consisted of about 30 containers on a vessel that could haul 60. Based on St. Paul's estimated annual total of 15,015 tons per season, this analysis uses 45 vans per trip.

When the barge returns to St. Paul from Dutch Harbor to pick up a shipment, it carries 45 empty vans to replace the full vans it will take away. This ensures that adequate refrigerated storage space is always available to the processors. The empty vans are unloaded and transported to the staging area following the same procedure itemized in table B-5.3 for 60 vans. Wharfage fees, loading time at Dutch Harbor, unloading time at St. Paul, and moving empty vans to the staging area are adjusted to reflect only 45 vans. Since the barge returns to Dutch Harbor with 45 full vans, the cost of the return trip is included in the transportation cost of delivering full vans to Dutch Harbor. The total cost of delivering 45 empty vans to the staging area at St. Paul is $41,200. (See line 1 in table B-5.4.)

After the empty vans are moved to the staging area, full vans are moved from the staging area to the dock. It takes 7.5 hours to move 45 vans to the dock using two tractor trailers and a forklift. The cost of moving the vans, including the equipment and five-man crew, is $244 per hour. The full vans are loaded onto the barge following the same procedure as for unloading. A single crew with forklifts uses the ramp connecting the dock and barge to load vans at a rate of six per hour. A single crew with two forklifts costs $325 per hour.

The barge is in port 7.5 hours to load full vans. Time spent preparing to load full vans and undocking is included in the time-in-port calculations for unloading empty vans. Wharfage fees of $4.00 per ton are charged for the full vans. The barge travels to Dutch Harbor from St. Paul at a rate of 6.5 knots, taking 36.8 hours to traverse the 239 nautical miles.

An analysis of wave buoy data for the Bering Sea concludes that when waves are greater than 10 feet outside St. Paul Harbor, conditions inside the harbor prevent vessels from entering the harbor and prevent loading and unloading processed seafood products. The data indicates that wave heights greater than 10 feet occur 36.5 percent of the crab season, January through March. Eight events or periods of wave heights greater than 10 feet are typical for the 3-month period. These events last an average of 98 hours. Using the midpoint of each event as the arrival time, the expected delay for each event is 49 hours. The average delay for the barge would be approximately 18 hours (49 hours times 0.365). Delay costs are calculated based on 18 total barge visits: 9 visits with delay on arrival and 9 visits with loading delays. Total delay costs are $137,000, shown on line 17 in table B-5.4.

The vans are offloaded at Dutch Harbor and moved to a temporary storage area. According to Sea-Land Service Inc., offloading with a gantry crane takes 3 hours using a single crew and crane. The barge is in port for 5 hours: 1 hour to dock, 3 hours to unload vans, and 1 hour to undock. Docking time at Dutch Harbor is much shorter than at St. Paul because the dock space is easily accessible and uncrowded.

Although it takes only 3 hours to unload the vans, the crew costs $1,685 per hour for a minimum of 6 hours. (The crew is in a standby mode when not loading vans and is on site for the full 6 hours.) According to one of the shipping companies that move product from St. Paul to Dutch Harbor, the amount of time loaded containers stay in Dutch Harbor depends on the sailing schedule of the container ships. The vans stay an average of 4 days in temporary storage waiting until a full load for one of the container vessels is accumulated. The refrigerated cargo vans cost $8.00 per day to operate while holding in the temporary storage area.

U.S. customs clearance begins with a review of the bill of lading documents. The inspection may also include a visual check of the cargo in the vans to confirm quantities and a random-sample inspection of individual boxes to confirm contents. After the customs inspection, the vans are transferred to a large container ship using a gantry crane.

The vans are loaded onto the large container ship in 1.8 hours using vessel cranes. The hourly rate of a loading crew at Dutch Harbor is $1,685. The container ship then moves the shipment 2,550 nautical miles to Japan at a speed of 18 knots. The 28,000-deadweight-ton (DWT) U.S.-flag container ship that takes the shipment to Japan measures approximately 676 feet in length and carries 1,600 TEU (twenty-foot equivalent units). One TEU is the equivalent of a 20-foot van; those used at St. Paul are 40-foot vans. Thus, 1,600 TEU is equivalent to 800 40-foot vans. Based on vessel cost information from the Institute for Water Resources (IWR), the vessel's operating cost is $1,437 per hour. Allocating the percentage of total vessel operating cost to the 45 vans of St. Paul product on the basis of TEU's yields $90 per hour per van. Total transportation cost for transshipment of the 45 vans of product to Japan is $12,700.

Empty vans are transported to Dutch Harbor from Seattle, WA, on a large container vessel. Dutch Harbor is 1,707 nautical miles from Seattle, and it takes 94.8 hours to make the trip. The cost of moving empty vans from Seattle to Dutch Harbor, using the proportional vessel operating cost of $90 per hour, is $8,500.

Refrigerated container vans do not remain on St. Paul following the crab season. To avoid double counting in the transportation analysis, costs associated with replacing full vans have been deleted for the last three trips of the season. The total cost of transporting processed seafood from St. Paul to Japan using a barge and large container ship is equal to the sum of the cost of the initial movement of 120 empty vans to St. Paul; the cost of replacing full vans and transporting seafood product; the cost of transporting seafood product without replacing full vans; and the cost of delays associated with entering and departing St. Paul Harbor. The total annual cost is $2,237,000, and the cost per ton, based on 15,015 tons of processed seafood product, is $149. The calculation is presented in table B-5.4.

TABLE B-5.4.--*Derivation of cost per ton to ship processed seafood product from St. Paul to Japan under without-project conditions*[a]

Line #	Item	Amount
1	Load and transfer 45 empty vans to St. Paul (a)	$41,227
2	Move full vans to dock (7.5 hours × $244/hour)	1,830
3	Load full vans on barge (7.5 hours × $324.82)	2,436
4	Cost in port (7.5 hours × $382)[b]	2,865
5	Wharfage at St. Paul ($4.00 × 825) + $900	4,200
6	Depart for Dutch Harbor (DH) (36.80 × $466/hour)	17,149
7	Dock and wharfage at DH ($425 + ($4.00 × 825) + $900	4,625
8	Move vans to temporary storage area	10,110
9	Time in port (5 hours × $382)	1,910
10	Container storage cost at DH ($8.00 day × 45 containers × 4 days)	1,440
11	Move vans to large container ship (45 containers ÷ 25 containers/hour × $1,685)	3,033
12	Transportation to Japan (141.7 hours @ $89.91/hour)	12,726
13	Transport empties to DH Seattle to DH: 1,707 nmi ÷ 18 knots = 95 hours × $89.81/hour	8,517
14	Cost to transport product to Japan & empty vans to St. Paul (b)	112,068
15	Cost to transport product to Japan without empty vans [(b · a) + $17,134 + 2,796]	90,771
16	Move 120 empty vans to St. Paul (table B-5.3)	123,500
17	Delay cost: 9 trips w/delays on arrival (9 × 18 hours × $466 at sea) 9 trips w/delayed loading (9 × 18 hours × $382 in port)	 75,492 61,884
18	Move empty vans & product to Japan (15.2 trips × $112,068/trip)	1,703,434
19	Move product only to Japan (3 trips @ $90,771)	272,313
20	Total cost,	$2,236,623
21	825 tons × 18.2 trips = 15,015 tons	
-	**Cost per ton**	**$149**

[a] The procedure of taking full vans to the processor, loading at the processor's facility, and returning the van to the staging area is essentially the same as in the with-project condition. The last three of the season's 18 shipments do not require transporting empty vans to St. Paul.
[b] Docking and undocking are in step 1.

With-Project Condition. With the proposed harbor design changes, a refrigerated cargo vessel (RCV) would be able to enter St. Paul Harbor and load cargo dockside, which it is unable to do now because of its size and physical configuration. This 4,500-DWT vessel measures approximately 325 ft in length. After loading, the vessel would proceed to Dutch Harbor where it would clear customs at anchor. No cargo transfer would be necessary. The cargo would stay on the vessel until its arrival in Japan. The derivation of the cost per ton for shipping finished product to Japan in the with-project condition is shown in table B-5.5.

TABLE B-5.5.--*Derivation of cost per ton to ship processed seafood product from St. Paul to Japan with St. Paul harbor improvements*[a]

Line #	Item	Amount
1	Travel cost for refrigerated cargo vessel (RCV) to reach St. Paul from offshore processor, 4 miles; 1 hour @ $634/hour	$634
2	Tug assist at St. Paul Harbor, 1 hour @ $1,100 & 1 hour @ $400	1,500
3	Move 45 vans from staging area to loading area at dock ($243.81 × 45 vans ÷ 6 vans/hour)	1,829
4	Unload vans at dock, 7.5 hours @ $174.82/hour	1,311
5	Dock fee ($1.70× 325)	553
6	Wharfage fee ($4/ton × 825 tons)	3,300
7	In-port cost:	
	Traveling in & out of harbor & docking (6 h @ $512)	1,849
	Loading cargo (15 hours @ $512)	7,680
	Tug assist	1,500
8	Transit to Dutch Harbor for U.S. customs (14.05 hours × $634/h × .204)	1,817
9	Cost in port (at anchor) for customs inspection (6 hours × 512 × .204)	627
10	Transit to Japan (2,551 nmi ÷ 17 knots × $634 × .204)	19,408
11	Total cost of transporting product to Japan, 1 trip	$42,007
12	Cost of delay on arrival (9 trips × 18 hours × 634)	102,708
13	Total cost of transporting season's St. Paul product to Japan: (18.2 trips × $42,007/trip) + delay cost	$867,243
14	**Cost per ton ($867,243 ÷ 15,015 tons)**	**$58**

[a] Same number of trips per season as without project; adjust $/hour by .204.

These RCV's, often called trampers, operate throughout the western Bering sea carrying break-bulk frozen seafood products to Asia. Most trampers are owned by small, privately held Asian companies and are not part of the large fleets of the major transportation companies. Their operation in Alaska is highly competitive. These RCV's carry primarily product produced from at-sea processors and smaller shore plants. The large land-based processors in Dutch Harbor and Akutan ship their goods primarily by refrigerated cargo containers on large container ships. Seafood processors put out radio, fax, and phone announcements when they have frozen seafood cargo to ship. They select carriers based on their bids to haul the cargo and their ability to take the cargo within the time requirement of the processor. At-sea processors have little flexibility in offloading finished product. If they fill their refrigerated cargo holds with product, they must cease processing operations. Under the current limited season openings, delays in processing can be economically disastrous. Therefore, at-sea processors begin arranging transshipment of product just prior to filling their holds, and timing of the offload to the RCV is critical. Shore-based processors like those on St. Paul have more flexibility in their timing of product transshipment. They have enough refrigerated cargo containers in reserve for storage of frozen finished product to allow a week or more of flexibility in offloading.

Trampers operating around St. Paul Island would likely take cargo from one or more of the 19 floating processors and 22 at-sea catcher processors with critical offload constraints, and then top off their cargo holds with product from the three shore-based processors in St. Paul which are under less of an offload timing constraint.

Offloading the harvested crab, loading the refrigerated cargo vans with finished product at the processors, and moving the vans to the St. Paul staging area would be virtually identical to these actions in the without-project condition. The finished product, in boxes, would be stacked on wooden pallets, and the pallets would be loaded into the vans with a forklift. Later, forklifts would remove the palletized product from the vans and set it on a cargo net dockside. Lining the vans with pallets adds only an insignificant amount of time to the processors' loading operations.

Self-contained refrigerated vans would still be necessary in the with-project condition, as there are no large refrigerated storage facilities at St. Paul. The refrigerated vans would continue to be used for storage.

The processors would arrange for a cargo vessel to arrive at St. Paul. The RCV would travel approximately 4 nautical miles from a floating processor to top off at St. Paul Harbor. The RCV would need the assistance of a tug to enter the improved harbor. According to Padilla Tug Company, a tugboat operates in the St. Paul area during the crab season. The tug is often used to help floating processors offload processed seafood product. The tugboat costs $1,100 for the first hour and $400 for each additional hour. Tug assistance would be required for 2 hours entering the harbor and 2 hours leaving the harbor. Total tug costs would be $3,000 each trip.

Before the RCV arrived, full vans would be moved from the staging area to the dock. It takes 7.5 hours to move the vans using two trucks. When the RCV arrived, the vans would be unloaded with two forklifts at a rate of eight vans per hour. A four-man crew and two forklifts cost $174.82 per hour. The unloading rate is slightly faster than the delivery rate (six runs per hour), so unloading costs are based on 7.5 hours to be consistent. Empty vans would be returned to the staging area after they are unloaded.

The palletized product would be placed into a cargo net and lifted into the vessel holds by the ship's crew using the vessel cranes. It takes 15 hours to load 825 tons, the total tonnage in 45 vans, using two of the ship's cranes. Loading costs are included in the vessel's in-port hourly operating cost of $512 per hour. NRC provided the information regarding the handling of palletized seafood product.

Dock fees of $1.70 per foot are charged at St. Paul. Dock fees for the RCV would be $553. Wharfage fees are charged at $4.00 per ton. Wharfage for 825 tons of product would be $3,300.

The RCV would be in port 15 hours to load processed seafood. Traveling in and out of the harbor with tug assist would take 2 hours each way. After docking, the ship would take 1 hour preparing to load product and another hour to prepare for departure after loading is completed. Tug assistance cost would be $1,500. Total cost in port, including tug assistance on departure, would be $11,000.

The RCV would depart St. Paul for Japan via Dutch Harbor. The trip to Dutch Harbor takes 14 hours. Prior to departure for Dutch Harbor, arrangements would be made with U.S. customs to inspect cargo upon its arrival at Dutch Harbor. According to U.S. customs, cargo would be inspected while the vessel is at anchor. The entire procedure rarely takes more than 6 hours. Two hours are required to review the bill of lading documents and 4 hours to inspect the cargo.

The hourly vessel operating cost for a 4,500-DWT refrigerated cargo vessel was provided by the Institute for Water Resources (IWR). Hourly operating cost is $634 when at sea and $512 when in port. These costs were adjusted to account for the proportion of St. Paul cargo on the vessel. The load factor used for apportioning vessel operating cost is 0.9. Total tonnage allocated to the vessel's cargo is 4,050 tons (4,500 DWT x 0.9). The proportion of St. Paul tonnage to total tonnage would be 0.204 (825/4050). The hourly vessel operating cost used for St. Paul tonnage is $129 at sea ($634 x .204) and $104 in port ($512 x .204).

Cost in port awaiting customs inspection would be approximately $600. After customs inspection, the RCV would depart for Japan. The trip is 2,551 nautical miles and takes 150 hours. The at-sea cost would be $129, and the total trip cost would be $19,400.

As discussed in the without-project condition, delays associated with high wave conditions occur 36.5 percent of the crab season, and the average delay is approximately 18 hours. Based on 18 visits during the season, 9 delays are expected to affect arrivals and 9 would affect loading. However, with the harbor improvements, the RCV would be able to load product during the high wave conditions. Delay costs are calculated for 9 arrivals with 18 hours of delay. Using the hourly vessel operating cost at sea of $634; the total cost of delays would be $102,700.

The total cost of transporting 15,015 tons of processed seafood, a year's St. Paul output, to Japan using refrigerated cargo vessels would be $867,000. The cost per ton would be $58.

The project benefit, then, would be the difference between $149 per ton and $58 per ton to transport the year's 15,015 tons of product from St. Paul to Japan, or $867,000 subtracted from $2,237,000. The benefit would be <u>$1,370,000</u>.

5.1.3 Reduction in Crab Deadloss.

To be accepted by processors, tanner, king, and hair crab must be kept alive in refreshed seawater tanks aboard the harvesting vessel until delivery. Crab that die during the harvesting operation are termed deadloss. These are subtracted from the landed catch and discarded. Fishermen are not paid for deadloss, and this crab harvest is removed from the biomass and wasted. While deadloss results from a variety of factors, it is caused primarily by excessive holding times aboard the fishing vessel. Crab fishermen report that most deadloss occurs near the end of a fishing trip, when crab harvested early in the trip are nearing their maximum allowable holding period (from 5 to 7 days, depending on conditions). Fishermen report that deadloss increases during rough weather when the vessel and catch are rocked and pounded by heavy seas.

Vessels that deliver to St. Paul generally have a shorter distance to run from the fishing grounds than those that deliver to Dutch Harbor. Therefore, the St. Paul-delivering vessels hold crab on board for a shorter time than those delivering to Dutch Harbor, usually saving 1 to 3 days. ADF&G records show that deadloss for tanner crab, both *opilio* and *bairdi*, reported at St. Paul Harbor during periods of good weather is typically lower than the Bering Sea average deadloss per vessel. However, during periods of inclement weather, fully loaded crab catcher vessels are often required to wait outside the St. Paul harbor because of unsafe conditions. If the waiting period is expected to be more than 2 or 3 days, the processor may ask the vessels to go to Dutch Harbor to offload, increasing onboard holding time by a day or more. The limitations of the entrance channel, maneuvering basin, and moorage facilities in St. Paul Harbor require vessels to wait at sea for one or more days before being allowed in port to offload crab, as reported by processors and documented by the harbormaster's records. Fishermen report these delays result in significantly increased deadloss.

Natural Resources Consultants, Inc., (NRC) obtained ADF&G records of deadloss and number of deliveries to St. Paul Harbor for the tanner *opilio* and *bairdi* crab fisheries during 1994. The deadloss per trip averaged 1,033 pounds (lb) in the *opilio* fishery and 829 lb in the Tanner *bairdi* fishery. Based on fishermen's interviews, the average deadloss per trip is believed to double when offloading is delayed by 24 hours.

During the 1994 *bairdi* fishery (November 1-21, 1994), the St. Paul harbor was closed due to weather (not including closures for ice) on 13 of the 20 days the season was open. During the 1994 *opilio* season (January 15-March 1, 1994) the St. Paul harbor was closed to vessel traffic due to weather (not including closures for ice) on 5 of the 45 days the season was open. In 1994, the hair crab season ran concurrently with the tanner *bairdi* season, closing on December 12, 1994. The 13 days of weather-related harbor closure affected deadloss in the hair crab fishery, although this fishery is not included in this deadloss analysis due to a lack of information from fishermen on deadloss causes.

NRC interviewed several crab fishermen concerning their experience with deadloss of tanner crab harvested near St. Paul Island. Those interviewed included Ron Peterson and Gordon Blue, both of whom have years of experience fishing in the area. Additional comments were solicited from Rance Morrison, the ADF&G Dutch Harbor shellfish manager, and Jerry Reeves, NMFS crab expert. Deadloss in harvested crab occurs for a variety of reasons including injury to crab during the harvesting or holding period; insufficient water circulation in the holding tank; and injury from abrasion in the tank, particularly during rough weather when the vessel is rocked or banged by heavy seas. The most common cause of deadloss, however, is excessive holding time. Fishermen and crab biologists all agreed that at 5 to 7 days of holding time, deadloss begins to become critical. Crab caught during the first 1 or 2 days of a trip have significantly increased mortality near the end of a trip 7 or more days in length.

Fishermen seek to maximize the harvest efficiency of each trip they make during the ever-shortening seasons. Running and offloading time reduces fishing time, lowers the vessel's catch for the season, and results in higher operational expenses. Ideally, a crab boat operator would like to travel to the fishing grounds, fish until the vessel is completely filled with crab, return to port for immediate offload, and get back out to the fishing grounds. This ideal scenario is generally not the case. Fishermen must weigh the additional crab they may catch by extending their trip an extra day against the deadloss they can expect from crab caught earlier in the trip. Vessels rarely return to port with their maximum holding capacity of crab, because they cut their trip short to reduce deadloss.

Crab fishermen using St. Paul Harbor said in interviews that the inability to enter the port in rough weather or container barges blocking entry to the docks can significantly increase the holding time for tanner crab aboard their boats. During 1994, the *bairdi* tanner season lasted 20 days, from November 1 to November 21. During that 20-day period, access to offloading docks was reportedly restricted on 13 of 20 days due to weather or barge traffic. Crab fishermen reported having to wait outside the harbor during poor weather with a large amount of crab aboard for up to 2.5 days. They reported that deadloss increased 15 to 20 percent above that experienced on trips of a normal length. As discussed above, reports by St. Paul processors to the ADF&G indicate that deadloss increases in deliveries made after delays in offloading schedules.

The crab lost to deadloss is a net economic loss because it is discarded. The fishery is managed under a guideline quota that allocates a particular weight of crab for each season's harvest. The harvest guideline includes all crab landed, both live and deadloss. Factors increasing deadloss of crab act to reduce the net economic gain from the use of these valuable resources.

NRC obtained total deadloss landings at St. Paul Harbor from the ADF&G for the 1994 season (most recent data available). The total season deadloss was divided by the number of days during the season to yield the average daily deadloss. This is a conservative average daily deadloss value because, as described above, most deadloss occurs during only a few days of a trip. NRC reviewed St. Paul Harbor vessel use records during the 1994 tanner crab seasons, both *bairdi* and *opilio,* to determine the number of days that vessels seeking to unload live crab would have been restricted from entering St. Paul Harbor due to wave conditions and vessel congestion problems. Only wave-related delays and vessel traffic conditions were included in the calculation of delay days. Delays caused by other weather conditions, such as sea ice, were not considered. To determine the number of vessels likely to have been delayed in offloading crab, NRC obtained delivery schedules from the processors and verified these with ADF&G daily delivery records. Finally, NRC determined the average ex-vessel value of the two species of crab delivered during the current 1995 season from processor records and ADF&G landing ticket records. Table B-5.6 shows the results of these calculations.

TABLE B-5.6.--*Calculation of* bairdi *and* opilio *tanner crab deadloss value due to rough seas and vessel congestion in St. Paul Harbor, 1994*

Crab species	No. of vessels	No. of days impacted	Average deadloss (lb/day)	Total deadloss (lb)	1995 ex-vessel price ($/lb)	1995 ex-vessel value ($)
Bairdi	1	13	829	10,777	$2.75	29,637
Opilio	5	5	2,140	53,500	$2.42	129,470
Total	6	18	2,969	64,277		159,107

Sources: ADF&G, NMFS, NRC, and St. Paul harbormaster.

During the 1994 *bairdi* tanner season, NRC estimated that one vessel was delayed at least 13 days from delivering crab due to harbor conditions. The average daily additional deadloss was calculated as 829 lb. A total of 10,777 lb of deadloss out of a total season deadloss of 19,082 lb, or 56 percent, was attributed to harbor conditions at St. Paul during 1994. The average ex-vessel price of *bairdi* tanner crab in 1995 was $2.75/lb, for a total value of $29,637 (table B-5.6).

In the 1994 *opilio* tanner crab fishery, five vessels were delayed 5 days each, averaging 1,033 lb of additional crab deadloss per vessel per day, for a total of 25,825 lb. This was 13 percent of the 194,275 lb of total deadloss during the season. The average ex-vessel price of *opilio* tanner crab during the 1995 season was $2.42, for a total ex-vessel value of $62,497.

The allowable harvest quota of *opilio* tanner crab in the Eastern Bering Sea is expected to increase beginning in 1997 and continuing through 2000, based on abundance estimates of pre-recruit male crab. The harvest quota for *opilio* tanner in the Eastern Bering Sea is projected to increase in 1998 to about 295.9 million pounds, further increasing to 325.4 million pounds in 1999 and 292.9 million pounds in the year 2000. Increased harvest quotas will result in increased season length. Assuming that 1994 represents an average year in terms of the number of days of inclement weather and vessel congestion, that deadloss-per-vessel-day delay is fairly constant from year to year, and that about 15 percent of the total harvest quota will be landed in St. Paul (based on 1994 and 1995 landings), savings from deadloss of *opilio* tanner crab under with-project conditions are estimated to be about $129,500.

Based on expected increased harvest quotas and 1995 ex-vessel values, a total of 64,277 lb of *bairdi* and *opilio* tanner crab worth approximately $159,000 will be unnecessarily wasted due to conditions at St. Paul Harbor that would be significantly ameliorated with the planned improvements.

Without-Project Conditions. Since 1994 was not a particularly severe weather year (based on National Weather Service and St. Paul harbormaster records), it is anticipated that the number of vessel days of transit to Dutch Harbor due to weather and vessel congestion in St. Paul is conservative. Under the without-project condition, it is expected that crab deadloss will continue to be a problem and will result in economic losses.

With-Project Condition. The annual net economic benefit from reduction in deadloss of *bairdi* and *opilio* tanner crab is estimated at $159,000, based on projected harvests and ex-vessel prices in 1995. The economic benefit from crab deadloss savings can be expected to increase as additional *opilio* tanner crab quota is made available to the fleet.

5.1.4 Increased Crab Harvest from Russian Waters.

The Russian government allocates an allowable annual harvest of 1,750 metric tons (mt) of "snow crab" (tanner *opilio*) to the Western Bering Sea District, which includes the sea floor adjacent to the U.S./Russian convention line north of St. Paul Island. This Russian crab quota has gone largely unharvested each year due to lack of processing capability in the area. Russian and U.S. crab catcher-processors are drawn to the more lucrative and abundant king and tanner *bairdi* quotas in the Sea of Okhotsk.

NRC contacted a former TINRO (Russian federal fisheries agency) official and current joint-venture businessman to determine the potential for U.S. harvest and shore-based processing of the Russian Western Bering Sea District tanner *opilio* quota at St. Paul.

This businessman has conducted joint-venture crab and halibut harvesting and processing operations in Russian waters for the past 5 years. These operations have involved U.S. catcher vessels harvesting crab in Russian waters and delivering it to U.S. processing ships operating on the fishing grounds in Russian waters. Beginning in 1995, Russian regulations require that crab processing vessels operating in Russian waters be Russian-owned and Russian-flagged. The joint venture concept involves harvesting crab in Russian waters with U.S. vessels and processing the crab in U.S. waters, either on a floating processor or at a U.S. shore-based plant.

The Russian government approved the concept of a fishery for *opilio* tanner crab found in remote areas of the western Bering Sea near the Chukotka District (Autonomous Okrug). This area has no support base or port with sufficient infrastructure to support large-scale commercial fishery operations. It is one of the most remote and least supported districts in Russia. The Russian government foresaw no opportunity for crab fishery development in this area in the foreseeable future. Therefore, they accepted the crab operation concept and allowed catcher vessels to conduct test fishing operations in the area in the spring of 1995.

An agreement was finalized with the Russian government to purchase approximately 200 mt (440,000 lb) of *opilio* tanner crab quota from the 5,250 mt quota available from the area for the entire 1995 fishing year. The quota license was scheduled to terminate at the end of the allocation year on December 31, 1995. Based on the results of the earlier test fishery and the December 1995 feasibility fishery, the Russian *opilio* crab fishing concept appears to be sound and can be conducted as a profitable fishery. An estimated 875 mt (50 percent of the 1,750-mt quota) could be harvested by U.S. vessels within easy run of St. Paul.

5.1.5 Prevention of Vessel Loss Due to Unsafe Harbor Conditions.

The operators of the Alaskan Monarch reported to NRC that the loss of this vessel (valued at $1.4 million), was directly attributable to the unsafe conditions at St. Paul Harbor. The vessel was having technical difficulties and remained outside the harbor during severe weather due to reports of poor conditions inside the harbor. The vessel was lost because it could not safely enter the protection of the harbor. NRC has documented two additional near-misses experienced by vessels entering the harbor during storms.

An estimated <u>$86,000</u> per year of vessel and equipment losses will be prevented with the planned harbor improvements. This estimate is based on the assumption that without improvements to St. Paul Harbor, a vessel with a discounted value of $500,000 will be lost every 5 years.

5.1.6 Saving of Expenses Caused by Vessel Diversions to Dutch Harbor.

Processors on St. Paul arrange harvesting contracts for live crab with individual catcher vessels. The same processors operate in Dutch Harbor. When weather conditions close the St. Paul harbor due to overtopping of the breakwater, processors may divert loaded crab boats to Dutch Harbor to reduce deadloss from holding crab too long on board.

NRC examined the St. Paul harbormaster's records for days of port closures and determined that the St. Paul harbor was closed to crab catcher vessels a significant number of days during 1994 crab seasons. The closures were often on consecutive days. NRC interviews with processors indicated that vessels frequently were diverted to Dutch Harbor during the 1994 tanner *bairdi* and *opilio* seasons and the 1995 *opilio* season. Although the exact number of vessel diversions was not recorded, processors estimate 16 deliveries during the 1994 *opilio* fishery and 4 deliveries during the 1994 *bairdi* fishery were diverted from St. Paul to Dutch Harbor due to overtopping problems. ADF&G reports 211 deliveries to St. Paul processors during these two crab fisheries in 1994.

In addition, vessels harvesting crab in Russian waters will experience the same problems with St. Paul Harbor. Vessels fishing U.S. waters were diverted from St. Paul to Dutch Harbor 20 times out of 211 trips, or 10 percent of the time. Based on the current Russian allocation of 875 mt, vessels fishing in Russian waters will make 14 trips a year. Thus 2 trips per year will be diverted from St. Paul to Dutch Harbor. Table B-5.7 shows the expected loss to the Russian crab harvest attributable to these diversions to Dutch Harbor.

NRC interviews with experienced, knowledgeable crab catcher vessel operators indicate that for the 2-day additional running time to and from Dutch Harbor, average total variable expenses are $1,240, including $550 for fuel, $40 for lubrication, $410 for repair and maintenance, and $240 for food. Processors estimate 22 vessels will be diverted annually unless overtopping of the breakwater is reduced. Preventing unnecessary vessel diversions would result in <u>$55,000</u> total annual savings (table B-5.7).

TABLE B-5.7.--*Loss due to added transit expenses because of diversion of crab vessels from St. Paul Harbor to Dutch Harbor due to overtopping conditions*

Crab species	No. of transits to Dutch Harbor	No. of vessel days per transit	Vessel transit expenses ($/day)	1995 ex-vessel value ($)
Bairdi	4	2	1,240	9,920
Opilio	16	2	1,240	39,680
Russian *opilio*	2	2	1,240	4,960
Total	22	2	1,240	54,560

Sources: Icicle Seafoods, Unisea, Trident, Gordon Blue, Ron Peterson, St. Paul harbormaster's office, and NRC.

5.1.7 Operation and Maintenance Savings.

The main breakwater at St. Paul has undergone a significant amount of deterioration since its construction in 1990. The deterioration rate is much greater than originally anticipated. Two separate phenomena are causing this damage. Outer armor stone procured from the Camas Quarry in Washington, placed in the splash zone, is breaking up due to ice jacking in the frequent and intense freeze-thaw cycles at St. Paul. The Camas stone is a basalt formation with numerous fractures caused by overblasting. These fractures leave the stone susceptible to freeze-thaw degradation. The second cause of damage is loss of core stone through the lee-side filter stone. This loss is due to larger and longer-period waves than anticipated during design, and some lack of quality control in armor and filter stone placement on the lee side of the breakwater. The breakwater contains 1,900 armor stones, most of them placed in the splash zone. Between 900 and 1,000 stones show signs of freeze-thaw damage.

About 20 stones (500 tons) were replaced in 1995 in easy-access locations at a cost of about $200,000. This replacement was done as an add-on to an open Corps of Engineers contract for similar type work. The cost for the repair did not include mobilization and demobilization costs because the contractor already had the necessary equipment on St. Paul Island. Future repairs will have additional costs for mobilization and demobilization of contractor equipment and skilled labor because the contractor used for the 1995 repair will have left the island.

Alaska District personnel have inspected the main breakwater each year for the last 3 years. The problem of a steepening side slope and loss of core rock on the back side of the breakwater was first reported by the harbormaster in the fall of 1995. Video tape of the area was first reviewed at that time. Since then, recent inspections indicate that the areas of concern have not worsened; however, storms were not as severe in 1996 as in a typical year.

Without-Project Condition. Rehabilitation of the main breakwater is essential to restore it to the original as-built condition and maintain the usability of the harbor as authorized. When the 20 armor stones were replaced in 1995, it was estimated that a major rehabilitation effort would be required in 3 to 5 years. Therefore, for the purpose of this analysis, the initial rehabilitation is assumed to take place in 2000. Total cost of the initial rehabilitation in 2000 would be $5,343,000.

Another rehabilitation similar to the first would be needed after a 25-year interval, in 2025. The present value for the rehabilitation work in 2000 and 2025 would be $5,347,000. The annual cost over a 50-year period at 7.625 percent interest would be $418,000.

The timing of repairs is based on the need for holding the wave energy being transmitted through the breakwater to a level that can be tolerated by businesses operating in the lee of the structure. The structure already has lost a significant amount of core stone, as evidenced by the need to remove rock from the roadway several times per year. Large voids can now be seen in the interior of the structure. The threshold energy level for operating behind the structure is even now nearly exceeded. For the purpose of this analysis, we have assumed that a follow-on major rehabilitation/repair at the same cost would be required 25 years after the first. This is a conservative assumption; given the wave climate impacting the breakwater, a follow-on major repair could be needed much sooner. Additional smaller repairs similar in scope to the 1995 work could be needed also. Because of the mobilization and demobilization that would be needed, additional repairs similar to the one in 1995 can be expected to cost up to $700,000 ($500,000 mobilization and demobilization plus $200,000 for the repair).

Future repairs in the without-project condition would require hauling breakwater materials to stockpile areas because of the lack of space in the harbor. Replacement armor stone would most likely come from Nome, Alaska, because the St. Paul Island rock source cannot cost-effectively produce sufficient quantities of the large armor stone required. Yields of 18-to-20-ton stone on St. Paul Island are very low. Replacement core stone can be obtained on St. Paul Island. For estimating purposes, 950 armor stones are assumed to require replacement. The stones susceptible to freeze-thaw damage are located on the sea side, lee side, and cap of the structure.

The construction scenario for rehabilitation in the without-project condition is expected to be as follows: The contractor would mobilize equipment at St. Paul. The 25-to-30-ton cap stone would be removed and hauled to a stockpile area away from the harbor. Concurrently, the contractor would begin barging replacement armor stone from Nome. Armor stone would be removed from the breakwater and hauled to the stockpile area. Part of the filter stone would be hauled to the stockpile area, and the rest could be relocated to other areas of the breakwater that have had core material repaired. This would reduce hauling. As the barges from Nome arrive, the armor stone would be immediately placed on repaired sections of the breakwater to minimize handling. While the barge is returning to Nome, the contractor would continue repairing the core material and replacing filter stone and armor stone from the stockpile. When the rehabilitation is complete, the contractor would move its equipment and crews back to the lower 48 States.

This breakwater rehabilitation/repair would restore the breakwater to its original as-built condition, but would not solve or address the wave overtopping and transmission problems being experienced now at St. Paul.

With-Project Condition. The offshore reefs would eliminate the need to rehabilitate the breakwater. The structure would function adequately because the offshore reefs would reduce the size of the waves impacting it. Replacement of the armor stone and core material would not be required during the 50-year project life.

If construction of the offshore reefs is delayed past 3 to 5 years, it will be necessary to completely rehabilitate the existing breakwater to prevent possible failure of the problem areas. This would involve removal of armor stone, rebuilding the core layer to the specified thickness, and replacing the cracked and broken armor with new stone. Therefore, the offshore reefs should be constructed as soon as possible, preferably within the next 3 years, to avoid completely rehabilitating the main breakwater.

If the offshore reefs are constructed within the next 3 years, a major rehabilitation of the main breakwater will probably be unnecessary. The wave energy reduction due to the reefs would be sufficient to minimize any further damage to the core material on the back side of the structure. Minor maintenance would be required in the form of replacement of core stone and reworking the back side slope in the problem areas. The maintenance could be required in the next 3 y ears, depending on the severity of the winter storm seasons.

The harbor improvements would reduce wave heights at the structure by at least 50 percent. The armor stone weight requirement would be reduced to less than 20 percent of that now required. Armor from the Camas Quarry is not deteriorating to these dimensions, nor is there reason to believe it would do so in the future, as the natural fracture planes don't develop a unit this small. There would therefore be no need for armor replacement. Core loss is also expected to cease in the with-project condition, and the wave energy level should be low enough even with the existing loss to preclude the need for major core replacement.

Eliminating the need to rehabilitate the breakwater would provide an annual savings of $418,000.

5.2 Benefit Summary

Table B-5.8 summarizes the annual benefits for navigation improvements at St. Paul Island. The total annual benefits are estimated at $2,613,000.

TABLE B-5.8.—*Benefit summary*

Category	**Amount**
Prevention of damage from breakwater overtopping	$525,000
Savings in transportation of processed seafood	1,370,000
Reduction in crab deadloss	159,000
Prevention of vessel loss due to unsafe harbor conditions	86,000
Saving of expenses caused by vessel diversions to Dutch Harbor[a]	55,000
Operation and maintenance savings	418,000
Total annual benefits	$2,613,000

[a] $5,000 of this amount is for vessels harvesting Russian crab.

5.3 Sensitivity Analysis

5.3.1 Transportation Savings.

The sensitivity of project benefits to total tonnage of seafood product shipped on each RCV trip was investigated. Shipments of 30 vans (550 tons), 45 vans (825 tons), and 50 vans (915 tons) were evaluated to examine the impacts on transportation cost. Transportation costs with and without the project for the various tonnages are shown in table B-5.9.

TABLE B-5.9.--*Sensitivity of transportation cost savings to tonnage of seafood shipped per trip*

	Tonnage per trip		
Item	**550**	**825**	**915**
Without-project cost/ton	$187	$149	$141
With-project cost/ton	65	58	56
Savings/ton	$122	$91	$84
TOTAL SAVINGS (savings/ton x 1,015 tons)	**$1,838,000**	**$1,370,000**	**$1,266,000**

Total benefits would vary from $2,509,000 with 915 tons per trip to $3,081,000 with 550 tons per trip. The benefit/cost ratio would range from 1.6 to 2.0.

5.3.2 Vessel Cranes.

The improvements to St. Paul Harbor may permit the RCV to use four cranes to load palletized cargo instead of two. Increasing the loading rate by using two additional cranes would effect additional transportation savings of approximately $5.00 per ton, or $75,000 per year. Using four cranes would increase benefits to $2,688,000 and increase the benefit/cost ratio to 1.7.

REFERENCES

North Pacific Fishery Management Council (NPFMC). 1993 (Nov). "Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea/Aleutian Islands Regions as projected for 1994."

U.S. Army Corps of Engineers (USACE), Alaska District. 1995. "Reconnaissance Report for Harbor Expansion, St. Paul, Alaska."

APPENDIX D
CORRESPONDENCE

CITY OF SAINT PAUL
P.O. BOX 901
ST PAUL ISLAND, ALASKA
99660
(907) 546-2331
Telecopy (907) 546-3199

August 9, 1996

Colonel Peter Topp, District Engineer
Project Formulation Section
US Army Engineer District
PO Box 898
Anchorage, Alaska 99506-0898

Dear Colonel Topp:

This letter expresses the intent of the City of St. Paul, Alaska, to cooperate with the Federal Government in initiating construction of the St. Paul Harbor Project. We understand that St. Paul would be required to pay the non Federal share of the costs of construction of general navigation features as specified by Section 101 of the Water Resources Development Act of 1986 (Public Law 99-662), recognizing the legal limit of the Federal Government's obligation to this project as authorized by Congress.

We have reviewed a proposed draft Project Cooperation Agreement. The City of St. Paul is the organization empowered by law to provide the non Federal cooperation required for the St. Paul Harbor. We hereby inform you that it is our intent to enter into such an agreement if the harbor project is approved for construction by the Corps' Headquarters office.

The City of St. Paul wholeheartedly supports the construction of the St. Paul Harbor project, and we believe the City of St. Paul has the ability to obtain the non Federal portion of the project funds. We will seek to procure funding according to our Financing Plan.

It is further understood that if this letter of intent is acceptable, you, as District Engineer, will recommend that the funds for the Federal share of the harbor be procured. We understand that this letter is a statement of intent, not a binding contract.

Sincerely,

John R. Merculief
City Manager

CC: Senator Ted Stevens
Senator Frank Murkowski
Representative Don Young

STATE OF ALASKA

TONY KNOWLES, GOVERNOR

OFFICE OF THE GOVERNOR

OFFICE OF MANAGEMENT AND BUDGET
DIVISION OF GOVERNMENTAL COORDINATION

SOUTHCENTRAL REGIONAL OFFICE
3601 "C" STREET, SUITE 370
ANCHORAGE, ALASKA 99503-5930
PH: (907) 269-7470/FAX: (907) 561-6134

CENTRAL OFFICE
P.O. BOX 110030
JUNEAU, ALASKA 99811-0030
PH: (907) 465-3562/FAX: (907) 465-3075

PIPELINE COORDINATOR'S OFFICE
411 WEST 4TH AVENUE, SUITE 2C
ANCHORAGE, ALASKA 99501-2343
PH: (907) 271-4317/FAX: (907) 272-0690

August 2, 1996

John Burns
U.S. Army Corps of Engineers
PO Box 898
Anchorage, AK 99506-0898

Dear Mr. Burns:

SUBJECT: FINAL CONSISTENCY FINDING
St. Paul Harbor Improvements and
Environmental Assessment
STATE I.D. NO. AK 9606-17AA

The Division of Governmental Coordination (DGC) has completed the review of your project for consistency with the Alaska Coastal Management Program (ACMP). This consistency determination applies to the federal consistency determination required for the project per 15 CFR 930 Subpart C. On July 26, 1996 you were issued a proposed consistency finding for your project. This is the State's final consistency finding.

The project has the following components: a dredged entrance channel at -32' Mean Low Low Water (MLLW) and a maneuvering basin at -29' MLLW; a spending beach on the lee side of the detached breakwater; three offshore reefs parallel to the main breakwater, each 1,300' long, at a depth of -12' MLLW; and a wave energy channel 100' wide to increase the flow of water into Salt Lagoon. The project location is Village Cove, section 25, T. 35 S., R. 132 W., Seward Meridian, near the City of St. Paul, Alaska.

Based on the review of your project by the Alaska Departments of Natural Resources, Environmental Conservation, and Fish and Game, and the St. Paul Coastal District, the State agrees the activity is consistent to the maximum extent practicable as proposed with alternative measure. This measure includes:

1. An adequate supply of oil spill cleanup equipment shall be readily available on site, at all times during the construction, to contain and cleanup any oil or hazardous substance releases to the land and water of the State. any spill must be reported to the Department at 1-800-478-9300.

RATIONALE: This stipulation is necessary to protect against the destruction of important habitat by the accidental discharge of a toxic material.

This measure is necessary for consistency with the ACMP Habitat Standard (6 AAC 80.130).

The following State permits also are needed for the project:

Alaska Department of Environmental Conservation
401 Water Quality Certification

Alaska Department of Natural Resources, Division of Land
Material Sale Permit
Tideland Lease Permit

If changes to the approved project are proposed prior to or during its siting, construction, or operation, you are required to contact this office immediately to determine if further review and approval of the revised project is necessary.

The State reserves the right to enforce compliance with this final consistency finding if the project is changed in any significant way, or if the actual use differs from the approved use contained in the project description. If appropriate, the State may amend the State approvals listed in this final consistency finding.

Other Concerns or Advisories
The Alaska Department of Natural Resources, Division of Land finds this project consistent with the ACMP contingent on submittal of two DNR applications:

1. A Material Sale application for dredged material that leaves current lease or Alaska Tideland Survey areas (the proposed fastlands/spending beach appears to be outside state ATSs or lease areas). A complete environmental risk form is also required.

2. A Tideland Lease application: it appears parts of the proposed project are outside existing ATSs/current leases (particularly the offshore reefs and the spending beach). Current City tidelands do not appear to cover all of the project. There is also the need for a complete environmental risk form.

Original applications and fees should be submitted directly to the DNR Public Information Center, 3601 C Street, #200, Anchorage, AK 99503, with a copy of the sheet sent to you previously. Be sure to include the sheet, since the coastal zone questionnaire has already been submitted. This will expedite processing. If you have any questions, please contact Kim Kruse, Division of Land, 269-8564. The Public Information Center has land status maps and tideland survey maps.

In our telephone conversation today, you stated that the City will be sending in these applications as soon as possible.

I have received no comments concerning your Environmental Assessment.

If cultural or paleontological resources are discovered as a result of this activity, we request that work which would disturb such resources be stopped and that the State Historic Preservation Office (762-2626) be contacted immediately so that consultation per section 106 of the National Historic Preservation Act may proceed.

Please be advised that although the State has found your project consistent with the ACMP, based on your project description and any alternative measures contained herein, you are still required to meet all applicable State and federal laws and regulations. Your consistency determination may include reference to specific laws and regulations, but this in no way precludes your responsibility to comply with other applicable laws and regulations.

Thank you for your cooperation with the ACMP.

Sincerely,

Faye E. Heitz

Faye E. Heitz
Project Review Coordinator

cc: Ali Iliff, DNR, DOL
Gary Saupe, DEC
Wayne Dolezal, DFG
Tim Smith, DNR, SHPO

UNITED STATES DEPARTMENT OF COMME[RCE]
National Oceanic and Atmospheric Administrati[on]
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

June 26, 1996

Alaska District, Corps of Engineers
CENPA-EN-CW-ER (Burns)
P.O. Box 898
Anchorage, Alaska 99506-0898

Dear Sirs:

The National Marine Fisheries Service (NMFS) has reviewed the Harbor Improvements Draft Interim Feasibility Report, St. Paul, Alaska, and offer the following comments and recommendations.

General Comments

The NMFS has responsibilities for many of our nation's trust resources, including marine fish, marine invertebrates, marine habitats, and certain marine mammals. The NMFS is also a major landowner in the Pribilof Islands and has been intensively involved in the resource development issues surrounding the islands during the last decade. The expansion of the existing harbor continues a series of major projects which have resulted in new and significant threats to the natural resources of the Pribilof Islands. Our agency has been particularly concerned with the northern fur seal population and that species' sensitivity to oil spills. The growth of the Pribilofs as a fishing and processing center has brought with it an increase in illegal discharges of pollutants, and vessel sinkings and groundings.

We believe the harbor expansion potentially presents an opportunity to improve certain conditions on St. Paul, and to reduce vessel groundings within Village Cove. The effort to improve water quality within Salt Lagoon through the construction of a storm channel represents a planning element with positive environmental effects. The recommended plan will contain measures to reduce inner harbor use by juvenile fur seals, which might otherwise become oiled or harmed by in-harbor activities.

The plan should identify and emphasize measures to prevent the introduction of rats to the island. Rats have been found in Fish and Wildlife Service traps recently, and there now exists a demonstrated potential for establishment of rat populations on the Pribilofs. Introduction of rats could have disastrous consequences to indigenous birds and marine mammals. This is such a serious threat that it potentially supports a decision against harbor expansion and tramp steamer service. We believe a determination by the Corps that this proposed construction would

U.S. Army Corps of Engineers

Response to National Marine Fisheries Service letter of June 26, 1996 on St. Paul Harbor Improvements

General Comments:
The city of St. Paul has agreed to establish a fully committed rat prevention program. The details of this program will be negotiated with the U.S. Fish and Wildlife Service, and your agency, if you wish to participate. The program will become part of the Federal project, and the cost to run the program will be included in the final plan.

not have significant adverse impact to the resources of national importance found on St. Paul can only be made if effective rat introduction preventative measures can be identified and assurances can be made these measures will be carried out by the City of St. Paul or other local entities. The interim draft does not provide adequate information to evaluate the effectiveness of future or on-going rat control efforts, and we recommend the final document contain a thorough discussion of this plan.

Specific Comments

A. Draft Interim Feasibility Report

Page 10, 2.3.2 Endangered and Threatened Species
The first sentence should read "Two species of birds, six species of whales, and one pinniped species listed..."The gray whale is no longer listed under the Endangered Species Act, bringing the number of listed whales in the vicinity to six. The statement that the Steller sea lion does not occur on St. Paul is incorrect; two haul outs occur on or adjacent to the island at Sea Lion Neck and Sea Lion Rock.

Page 15, paragraph 4
It is incorrect that resource agencies were satisfied the Corps project would not significantly alter Salt Lagoon. Monitoring did not indicate significant pollutants within the Lagoon which could be from the harbor operations, but long-term impacts or changes were not addressed. Also, major changes in circulation and sedimentation within the entrance to the Lagoon, including a major realignment of the entrance channel, were attributed to breakwater construction.

Page 38, 5.1.5
We strongly support this feature and the recommended monitoring effort during construction to evaluate its effectiveness. We are available to meet with the Corps and resource agencies to scope the necessary planning and monitoring (performance) objectives.

Page 52, 5.11
The views of the Fish and Wildlife Service are not discussed within the document. This section lists six (not three as stated) planning objectives; but there is no corresponding response from the Corps as to whether the recommendations have been adopted.

B. Finding of No Significant Impact and Environmental Assessment

Page EA-17, paragraph 2
The incorporation of capstones and an improved inner-harbor spill containment system is a very important attribute to the expanded harbor. We would like to see this feature fully developed within the final planning documents. This section should also discuss the community's current and future plans to provide for waste

Specific Comments:
Draft Interim Feasibility Report--

1. **Page 10, 2.3.2.** Correction made.

2. **Page 15.** Correction made. The monitoring studies were conducted because the effects to Salt Lagoon from the breakwater construction were uncertain. The studies demonstrated an adverse impact to Salt Lagoon, which initiated the study to improve circulation within Salt Lagoon.

3. **Page 38.** Concur. Monitoring program will be established.

4. **Page 52.** All of the recommendations from U.S. Fish and Wildlife Service have been adopted. Refer to new subsection 7.4 in the report.

Environmental Assessment--

1. **Page EA-17.** We did not consider the use of capstones or attachment locations for harbor facilities except for the fill behind the detached breakwater. The oil boom attachment facilities were eliminated from the fill when the fill design was changed to intertidal. The Alaska District will investigate the use of capstones or other types of oil boom attachments during the Preconstruction Engineering and Design phase.

facilities under MARPOL II.

Page EA-21, Seabirds/Rat Introduction
The introduction of rats would also impact fur seals and other marine mammals through the introduction of disease.

Page EA-23, paragraph 4
The NMFS has not entered into any agreement to jointly manage the fur seal population on St. Paul. We will continue to work closely with the City to insure harbor operations do not impact these animals.

Page EA-25, 5. Secondary and Cumulative Impacts
The potential introduction of rats should be considered as a secondary or indirect impact of the expansion. Also, the project may induce additional processing activity, which should be addressed in this section.

We appreciate this opportunity to comment, please direct any questions to Brad Smith at (907) 271-5006.

Sincerely,

Steven T. Zimmerman, Ph.D.
Chief, Protected Resources
Management Division

2. Page EA-21. The city of St. Paul is concerned about the introduction of rats from a fish and wildlife (birds and seals) standpoint, but also because of the human health considerations. The city of St. Paul and the U.S. Fish and Wildlife Service will be formulating a rat prevention plan for the city to implement. Your agency is invited to participate in formulating this plan.

3. Page EA-23. City of St. Paul officials have indicated they frequently confer with your agency on the management of the fur seal populations. The reference to an agreement has been deleted.

4. Page EA-25. The potential of secondary impacts with the usable fill behind the detached breakwater was a major concern for the Alaska District. An Environmental Impact Statement was planned and a Notice of Intent to Prepare an Environmental Impact Statement was published in the Federal Register in December 1995 because of potential secondary impacts associated with the fill and access to the fill. The predicted wave climate within the harbor required shallow side slopes, which decreased the surface area of the fill and required a substantial pile-supported dock to be constructed to reach sufficient water depths for boat moorage at all tides. The potential of fur seals using the spending beach for hauling out was significant enough to design the spending beach to be intertidal, thus limiting seals from full-tide use. The Alaska District will not allow any new structures within the boat basin that could cause changes in the harbor's wave climate. Steep-faced fills and sheet pile docks would reflect wave energy and alter the wave climate. Pile-supported structures would be acceptable from a hydraulic aspect; however, they are extremely expensive to construct from shallow-sloped beaches. The harbor's size, especially with the proposed spending beach, limits the potential for protected dock space without substantial and extremely expensive dredging. These factors were analyzed, and it was determined that the potential for secondary impacts, *i.e.*, additional processors, was extremely low. The present harbor is of sufficient size to accommodate most bottom trawlers. The existing onshore facilities will or will not process bottomfish with or without the project.

ALASKA MARINE CONSERVATION COUNCIL
Box 101145 Anchorage, Alaska 99510
(907) 277-5357; 277-5975 (fax); amcc@igc.apc.org

BY FAX AND MAIL

June 26, 1996

Mr. John Burns
Alaska District, Corps of Engineers
CENPA-EN-CW-ER
P.O. Box 898
Anchorage, Alaska 99506

Dear Mr. Burns,

The Alaska Marine Conservation Council is a broadbased, grassroots organization working to protect the health and integrity of the marine ecosystem. We recognize that the Pribilof Islands provide unique and sensitive habitat to a host of marine mammals, seabirds, and fishes of the Bering Sea. Development here should proceed cautiously with a mindful eye to cumulative impacts to the area waters and wildlife. We have reviewed the "Harbor Improvements Draft Interim Feasibility Report and Environmental Assessment and have the following comments.

Citing safety and congestion relief, dredging a deeper channel and turning radius makes sense for the future of St. Paul Harbor. Also, improving the flushing of the salt lagoon is important to prevent further eutrophication of lagoon waters.

The economic development likely to occur as a result of modifications to the harbor mandates serious precautions for maintaining water quality and preventing an invasion of rats to St. Paul Island. Threats to area wildlife--including fur seals, seabirds, fish, and invertebrates--can be minimized with proactive measures in place.

Therefore, we have the following recommendations:

1) Maintain an aggressive campaign to first prevent, but also to contain, oil spills or release of other contaminants within Harbor waters. The EA states that water quality is good within the Village Cove, and that seafood processors take their processing water from here. Flushing in the Salt Lagoon to prevent any further deleterious ecological changes there relies on clean water.

2) Maintain an aggressive rat control program, complete with mandatory inspections and monitoring of suspect vessels in the harbor. One lapse in such a vigil can have catastrophic consequences to the seabirds of St. Paul Island.

3) Institute a water quality monitoring program to maintain careful scrutiny as marine traffic increases. Subtle or cumulative changes must be monitored annually to effectively mitigate unforseen problems with pollution from oil spills or other contamination.

Significant oil spills, the introduction of rats to St. Paul Island, water quality degradation from petroleum products or other contaminants all threaten the integrity of important wildlife habitat which is inextricably tied to local people's culture, lifestyles, and economy. Particular attention must be given to potential effects to fur seals, least auklets, kittiwakes, and the ecologically important benthic community of Village Cove and Salt Lagoon. We strongly believe that the above recommendations are necessary as the St. Paul Harbor Improvements project progresses.

Sincerely,

Fran Bennis
Field Coordinator.

U.S. Army Corps of Engineers

Response to Alaska Marine Conservation Council letter of June 26, 1996 on St. Paul Harbor Improvements

The comments received from the Alaska Marine Conservation Council were similar to those of the National Marine Fisheries Service and to the recommendations of the U.S. Fish and Wildlife Service. Refer to the responses to those agencies.

MEMORANDUM

To: Colonel Peter A. Topp, Alaska District Engineer, Corps of Engineers

From: Tony Smith, Special Counsel City of St. Paul

Date: March 29, 1996

Re: Corps of Engineers Feasibility Study for the St. Paul Harbor Improvements (Financing Plan)

The financing of the local share of the St. Paul Harbor Improvements will be accomplished in the following manner:

1. The State of Alaska has included the St. Paul Harbor Improvements in its master plan. Attached as Exhibit A. The State has included $4.7 million as the amount of the State Appropriation necessary to provide for the local share. The project, at this time, is the highest rated project that has not completed the feasibility study stage. The projects that are ahead of St. Paul on the State priority list are those that are further along in the process. We believe that the State will be able to provide the requisite local match for the Corps project.

2. The Community Development Program has been reauthorized by the House in the Magnuson Reauthorization. It was also part of the reauthorization in the Senate that passed the Commerce Committee on March 28. Under the CDQ Program, infrastructure development is a legitimate use of the resources allocated to qualifying local communities (which includes St. Paul). The program allocates 7.5% of the groundfish, halibut, sablefish and crab resource in the Bering Sea to qualifying coastal communities in Alaska. The State of Alaska determines how that money can be spent and what communities are entitled to what percentage of the resource. The State has approved, for the CDQ Group on St. Paul Island (Central Bering Sea Fishermen's Association, CBSFA), the use of CDQ money as

part of the local match for the feasibility study and the planning, engineering and design phase. In approving the CBSFA budget allowing use of these resources for Harbor improvements, the State CDQ working group and Governor stated that the resources would be available for local match on the Harbor Improvements as they benefit the local, state, regional and national fisheries.

3. The City of St. Paul is the second largest recipient of fisheries revenue from the State of Alaska under the Alaska statutes that provide for revenue sharing of state fisheries tax with local communities. The 5 year record is attached as Exhibit B. This sum has been used by the City to construct infrastructure for the industry. These are revenues which the City receives each year, depending on the health and market price, calculated on the amount of seafood delivered within the 3-mile limit to St. Paul Island. This sum fluctuates, but it is clear that St. Paul is one of the major fishing ports in Alaska and perhaps the world. These sums are unencumbered revenues of the City of St. Paul which can be appropriated by the City Council by ordinance as necessary to meet local share requirements.

4. There are revenues, and offsets, which the City will receive for land disposal, rights of way and easements which will be appropriate credits against local share requirements pursuant to 33 U.S.C 2211 et seq. The City estimates that the value of the offsets is approximately $1.2 million. This sum should will satisfy a substantial portion of the City's obligations for local share. This is particularly the case when the other available funds as set forth in paragraph 1, 2, 3 and 5 are considered.

5. Section 3 of Public Law 104-91 requires the Secretary of Commerce to report to Congress on October 1, 1996 as to those steps that are needed to complete the phase out of the Fur Seal Harvest and the transition of the Pribilof Islands economy to fishing. Thirty million dollars has been authorized to implement this provision. The Improvements to the St. Paul Harbor are clearly one of the items that need to be completed.

The City of St. Paul and the State of Alaska are in an excellent position to provide the local share to complete this important project. It should be noted that the City of St. Paul has, through the reconnaissance and feasibility phases of this project, been willing and able to provide for local match in a timely and expedited manner so that the project can continue. The City of St. Paul's commitment to this project, and capability to meet its obligations, has not been diminished.

Corps Match Estimates 97-00

Project by Program Type	State Priority Score	Federal Status	Construction Start	FY 97 Match Estimated	FY 97 Federal Funds	FY 98 Match Estimated	FY 99 Match Estimated	Future Federal Funds	Remarks
General Investigations:				(in thousands)					Program requires Congressional Authorization and Approp positive benefit/cost ratio and 20-35% match
Unalaska(Northern Sea Route) Entrance Dredging	New Project, not scored.	Funds for FCSA (Feasibility Cost Share Agreement)	99	$ 65.0	$ 260.0				Project originated by Northern Searoute Study. City of Unalaska to st proposed includes 25% of match. City bring remainder of match to t
Homer Spit	Erosion projects not scored	Plans and specs	97	$ 300.0	$ 3,000.0				Protects the Sterling Highway on Homer Spit.
Kake Harbor	101	Plans and specs funding in place	97	$ 1,124.0	$ 9,012.0		$ 1,124.0		Commitment of 10% needed to start project in 97 balance due at co in 99.
Chignik Harbor	95	Feasibility Complete	99			$ 1,192.0		$ 4,212.0	progress satisfactory, early commitment helps federal project move
St. Paul Harbor	79	Feasibility	98			$ 4,718.0		$ 25,000.0	Preliminary Estimate
Cook Inlet Navigation	60	Feasibility near complete, funds for plans and specs approved.	98			$ ~~700.0~~ 751.0		$ 4,079.0	Draft comments being incorporated into document. $1.5 mil calculated benefits go to Sealand and TOTE. Port of Anchorage pro sponsorship with POA providing 50% of match.
Sand Point Harbor	55	Reconnaissance		$ 100.0	$ 300.0				Estimated
Seward Harbor Expansion	50	Reconnaissance							Estimated
Anchor Point Harbor	35	Deferred until sponsor identified							no local sponsor
Kodiak Harbor		Construction							Project complete in 96
Sitka Harbor		Construction							Project complete in 96
St. George Harbor		Indefinitely deferred							City will not sign project cost share agreement.
Continuing Authorities:									Program is discretionary, requires Chief Engineer approval, is $4 million, positive benefit/cost ratios and 20% match.
Larsen Bay Harbor	89	Feasibility	97	Not yet					OK
Ouzinkie Harbor 1.9	89	Plans and specs.	97	$ 200.0	$ 1,800.0				OK, for inner harbor dredging, a local responsibility. City looking for
Whittier Harbor	87	Feasibility	98			$ 1,200.0		$ 4,800.0	Prelim. Est., early commitment helps federal project move forward.
Williamsport Harbor	59	Awaiting letter of support from State	97						No need no dredging. ($1.8 million)
Tatitlek Harbor	53	Awaiting FCSA for feasibility							Federal decision pending
King Cove Harbor	47	Awaiting FCSA for feasibility							Federal decision pending
Tenakee Harbor		Awaiting FCSA for feasibility							Federal decision pending
Environmental Enhancements:									Program makes substantial environmental enhancem... to authorized Corps projects; requires 25% match.
Valdez Harbor Sec. 1135		Feasibility	98						Environmental enhancements
St. Paul Harbor Sec. 1135		Reconnaissance	97						Environmental enhancements
Flood Control:									Projects address flooding and erosion damage, requires pos benefit/cost ratio and 25% match.
Bethel Seawall		Continue construction	96	$ 1,720.0	$ 7,000.0				City plans to contributed $2,384,000, State has contributed $1,2[illegible] date.
[illegible] Erosion		Construction	98						Federal decision pending
[illegible] Erosion		Construction	98						Federal decision pending
Planning Assistance to States:									State Directed Program, requires 50% Match
Program Formulation	130	Continued funding expected in future years	97	$ 100.0	$ 100.0	$ 100.0	$ 100.0		
Sub-Total				$ 3,697.0	$ 21,372.0	$ 7,870.0	$ 1,224.0	$ 38,091.0	
Program change contingency				$ 303.0	$ -	$ 787.0	$ 122.4	$ -	
Program Requested Level				$ 4,000.0	$ 21,372.0	$ 8,657.0	$ 1,346.4	$ 38,091.0	

Harbor Evaluation
and Selection Process

Proposed Project Name:__________

Rater:_____
Date:_____
Total Score:___

	Standards	Scoring Criteria 5	3	0	-3	-5	Raw Score	Weight	Weighted
1.	Safety	Project is needed for critical safety reasons. Correcting hazards and deficiencies, or harbors of refuge that will reduce loss of life in the Alaska Peninsula, Aleutian Chain region.	Project improves safety of facility by reducing potential hazards and personal injury claims.	Project has no impact on safety	n/a	n/a		5	
2.	Maintenance Cost Impact	Deferred maintenance projects that substantially reduce maintenance cost to the State, or local government. New projects that provide substantial protection to existing facilities in exposed locations having a history of high damage and maintenance cost.	Deferred maintenance project that moderately reduces maintenance costs to State or local government. New projects that provide moderate breakwater protection to existing facilities in exposed locations.	Project will increase maintenance cost to State, local government.	n/a	n/a		3	
3.	Operational Importance of harbor component to be repaired, rehabilitated, constructed. (No score for new projects in this category.)	Component critical to operation of facility such as approach, gangway and floats.	Important, but not critical, components such as grids, water, electrical system, capacity improvements. Improvements that change function and provide more capacity.	Upland facilities (work floats, restrooms, harbor master offices, parking lots.) Improvements that change function but do not add moorage capacity.	n/a	n/a		4	
4.	Effective Service Life of repaired, rehabilitated, or constructed component.	Greater than 15 years	between 15 and 10	between 5 and 10	less than 5 years	n/a		3	
5.	Deficiency as percentage of replacement cost of facility being repaired.	Deficiency rating higher than 20%	Deficiency rating higher than 5%	Deficiency rating less than 5%	n/a	n/a		4	
6.	New Harbor Capacity.	Project will increase capacity to meet waiting list demand (over 30% of existing community capacity). No existing facility in community.	Project will increase capacity to meet waiting list demand (over 15% of existing community harbor capacity.)	Project will not increase harbor capacity	n/a	Project will reduce harbor capacity.		4	0
7.	Economic Impacts of project.	Supports significant new, identifiable, permanent economic opportunities or benefits statewide. Predominantly a commercial harbor. Improvement projects that preserve significant economic benefits. COE calculated B/C ratio of 1.5 or greater.	Supports moderate new, identifiable, permanent economic opportunities or benefits regionally or locally. More than 30% commercial. Preserves economic benefits. COE calculated B/C ratio of 1.0 or greater.	Supports minimal, speculative or temporary economic opportunities or benefits. Provides or preserves nominal benefits.	n/a	n/a		3	0
8.	Local Interest in project.	Resolution of support from local government, project and in official state/local plans. Desire for local ownership and operation included in resolution if a state owned facility. Commitment of substantial financial participation in project.	Letter(s) from local or borough government in support of project; may be in state/local plans and includes a commitment for local management and operation.	Projects with no indication of support.	n/a	n/a		2	0
9.	Environmental and project development.	Project has or is likely to receive a FONSI, or has a permit in place; is likely to to be covered by the nationwide permit for maintenance, or a completed environmental impact statement indicating project has advanced beyond concept and feasibility.	Project is in feasibility but not advanced enough to distinguish environmental status. Repair and replacement project that changes basic activity of facility but likely to be found acceptable.	New project with little or no environmental information available.	Project likely to have minor issues that may or may not be mitigated and found acceptable.	Project likely to have major issues that may or may not be mitigated and found acceptable.		3	0
									0

State of Alaska

DEPARTMENT OF REVENUE
Income and Excise Audit Division

SHARED TAXES AND FEES ANNUAL REPORT

For the Fiscal Year Ended June 30, 1995

The Honorable Tony Knowles, Governor
Wilson L. Condon, Commissioner

Alaska Department of Revenue
Income and Excise Audit Division
Larry E. Meyers, Director
P.O. Box 110420
Juneau, Alaska 99811-0420
Telephone (907) 465-2320
Fax (907) 465-2375
Home Page - http://www.revenue.state.ak.us

FY 95 in Retrospect

FY 95 shared taxes and license fees ($24,869,500) increased 22% over the total shared in FY 94 ($20,342,800), primarily due to increased collection of fisheries business taxes and first-year collection of fishery resource landing taxes. Department of Revenue disbursed FY 95 shared taxes and fees to 119 eligible municipalities. Over the past five fiscal years, FY 91 through FY 95, the Department has shared approximately $108 million to local governments.

Significant changes in shared taxes and fees over FY 94 are summarized below.

- ***Fisheries Business Tax*** - Shared fisheries business taxes increased $2,256,000 over FY 94 because of increased fisheries business tax collections which reflect higher harvests and prices paid for salmon during calendar year 1994 (fisheries business taxes for that year were due March 31, 1995). Shared fisheries business taxes for Saint Paul have risen significantly over the past five fiscal years to an all-time high of $2.5 million for FY 95. The increases are a result of Saint Paul's harbor development, completed in 1990, which has lead to three processors locating facilities in that community.

- ***Fishery Resource Landing Tax*** - The fishery resource landing tax took effect January 1, 1994. Calendar year 1994 tax returns were due June 30, 1995. First-year collection of landing taxes resulted in about $2.9 million subject to sharing. Due to pending litigation regarding the constitutionality of the landing tax, it is undetermined at time of publication whether to share with municipalities or escrow taxes until the outcome of litigation. Unalaska (Dutch Harbor) will be the primary benefactor of the shared landing tax program with approximately $2.5 million, or 87% of total shared landing taxes.

- ***Aviation Motor Fuel Tax*** - Shared aviation motor fuel taxes increased over FY 94 because of increased aviation activity, greater compliance toward reporting aviation fuel sales, and amended returns filed by an aviation fuel dealer to reflect a correction in their reporting method. Sitka relinquished ownership of its airport and returned it to the state effective July 1, 1994. The small amount of aviation fuel tax shared to Sitka represents June 1994 fuel sales which were reported in July 1994.

- ***Liquor License Fees*** - Shared liquor license fees stabilized to pre-FY 94 levels. The amount of shared liquor fees had increased for FY 94 because of statutes enacted in 1993 (Ch 63 SLA 93) which authorized biennial renewal of liquor licenses beginning in 1994. In transition to biennial licensing, half of liquor licensees filed a 1994 renewal application for a one-year period while the other half filed for a two-year period. As a result, the Department experienced a one-time increase in collection and sharing of liquor license fees for FY 94.

Amounts shared for the other tax types, ***coin-operated device, electric cooperative and telephone cooperative,*** were relatively unchanged from FY 94.

Table 8 - Fisheries Business Tax

City	FY 95	FY 94	FY 93	FY 92	FY 91	Total All Years
Emmonak	35,219	14,962	28,623	35,051	9,303	123,171
Fairbanks	100	0	0	5	47	152
False Pass	21,069	96,854	103,977	12,789	6,719	241,408
Galena	2,048	1,672	3,062	2,554	2,455	11,790
Goodnews Bay	302	347	132	0	17,405	18,186
Haines	637	708	907	2,571	1,302	6,125
Homer	91,790	84,334	109,945	93,158	126,649	505,876
Hoonah	99,264	57,853	63,658	53,377	58,883	333,035
Hooper Bay	1,268	0	0	5,502	0	6,770
Kachemak	0	0	0	27	0	27
Kake	73,376	33,611	2	16,517	0	123,507
Kaltag	0	475	2,229	2,572	1,876	7,152
Kenai	177,974	121,475	338,035	134,286	302,455	1,074,225
Ketchikan	323,163	209,225	308,340	216,403	252,977	1,310,108
King Cove	475,417	399,081	453,043	346,246	458,604	2,130,391
Klawock	0	5	23	0	214	242
Kodiak	644,353	556,915	865,429	613,703	874,193	3,554,593
Kotzebue	0	0	0	2	2,730	2,733
Larsen Bay	51,966	61,377	51,432	55,400	91,283	311,478
Mekoryuk	410	265	0	242	181	1,098
Nenana	578	96	795	1,276	1,086	3,831
Nome	0	0	0	197	0	197
North Pole	411	679	1,235	1,208	484	4,017
Nulato	0	0	0	0	671	671
Old Harbor	0	0	5,812	1,121	3,162	10,095
Ouzinkie	0	33	21	0	0	54
Pelican	165,808	132,518	147,420	163,111	172,183	781,041
Petersburg	826,209	746,865	736,286	599,536	729,582	3,638,479
Pilot Point	0	19,232	58,925	176	0	78,334
Port Heiden	0	0	4,391	0	0	4,391
Saint George	287,118	358,894	278,949	116,409	12,177	1,053,648
Saint Mary's	0	0	0	1,275	7,121	8,395

Table 8 - Fisheries Business Tax

City	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Total All Years
Saint Paul	2,534,079	1,877,080	715,786	1,140,370	748,353	7,015,668
Sand Point	90,021	93,049	144,081	111,509	87,629	526,289
Seldovia	0	0	0	21	7,281	7,302
Seward	125,329	142,157	187,378	164,983	283,904	903,751
Skagway	0	129	0	0	30	159
Soldotna	53	28	1,011	0	19	1,110
Tenakee Springs	0	680	0	0	6	686
Thorne Bay	970	0	0	0	0	970
Togiak	187,157	96,017	193,067	99,568	99,574	675,383
Toksook	0	15	0	0	13	27
Unalakleet	5,084	2,064	0	9,103	0	16,251
Unalaska	2,193,707	2,614,182	3,525,048	2,531,282	2,067,793	12,931,992
Valdez	287,993	127,678	201,963	249,496	368,659	1,215,788
Whittier	82,368	62,467	66,071	38,066	22,276	271,248
Wrangell	77,381	72,754	60,586	53,102	57,489	321,314
Total Cities	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
GRAND TOTAL	$18,500,221	$15,344,252	$20,195,923	$13,617,513	$16,205,762	$86,683,670
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* *The 1990 legislature amended fisheries business statutes by adding a new section, AS 43.75.137, to authorize sharing of 50% of fisheries business tax revenue attributable to processing activities in the unorganized borough (Ch 195 SLA 1990). Department of Community and Regional Affairs (DCRA) is responsible for disbursing to eligible communities the 50% share of revenue collected from the unorganized borough. AS 43.75.137 took effect July 1, 1992.*

Table 9 - Fishery Resource Landing Tax

	FY 95	FY 94 *	FY 93 *	FY 92 *	FY 91 *	Total All Years
Borough						
Aleutians East	$ 3,641	-	-	-	-	$ 3,641
Kenai Peninsula	10,315	-	-	-	-	10,315
Kodiak Island	18,533	-	-	-	-	18,533
Yakutat	3,266	-	-	-	-	3,266
Total Boroughs	35,756	-	-	-	-	35,756
City						
Atka	8,511	-	-	-	-	8,511
Kodiak	60,164	-	-	-	-	60,164
Saint Paul	229,839	-	-	-	-	229,839
Sand Point	1,042	-	-	-	-	1,042
Seward	45,036	-	-	-	-	45,036
Unalaska	2,512,253	-	-	-	-	2,512,253
Total Cities	2,856,845	-		-	-	2,856,845
GRAND TOTAL	*$2,892,601*	-		-	-	*$2,892,601*
Number of Communities Subject to Sharing	10	0	0	0	0	10
Additional Sharing with DCRA **	*$89,195*	N/A	N/A	N/A	N/A	*$89,195*

* *Fishery resource landing tax took effect January 1, 1994. Calendar year 1994 landing tax returns were due June 30, 1995.*

** *As part of the fisheries resource landing tax statute enacted by the 1993 legislature, section 43.77.060(d) authorizes sharing 50% of fisheries resource landing tax revenue for landings in the unorganized borough (Ch 67 SLA 1993). DCRA is responsible for disbursing the 50% share of revenue to eligible communities.*

CITY OF ST. PAUL HARBOR IMPROVEMENT PROJECT
LOCAL SPONSOR'S SHARE -
FINANCING PLAN

DESCRIPTIONS	AMOUNTS
Anticipated Authorization	$ 17,500,000
Latest Anticipated Cost **City's Nondeferred Share**	$ 16,100,000
Local Sponsor's Share	35%
Less Deferred Share	10%
Sponsor's Nondeferred Share **City's Nondeferred Dollar Share**	25%
Construction Cost	$ 16,100,000
Less Non-Navigation Features	($ 1,000,000)
Cost Sharing Total	$ 15,100,000
Local Sponsor's Share	$ 3,775,000
Plus Non-Navigation Costs	$ 1,000,000
TOTAL LOCAL SPONSOR COSTS **FINANCING PLAN**	$ 4,775,000
State of Alaska (75%)	($ 3,581,250)
Local credits and contributed revenues from construction	($ 1,200,000)
Local Sponsor's Share Overage	$ 6,250

TONY KNOWLES, GOVERNOR

DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
OFFICE OF THE COMMISSIONER

3132 CHANNEL DRIVE
JUNEAU, ALASKA 99801-7898

TEXT: (907) 465-3652
FAX: (907) 586-8365
PHONE: (907) 465-3900

March 26, 1996

Colonel Peter A. Topp
District Engineer
U.S. Army Corps of Engineers
P.O. Box 898
Anchorage, Alaska 99506-0898

Dear Colonel Topp:

Thank you for the opportunity to review the St. Paul Harbor Improvement Study. The project proposes to accomplish a number of important improvements. First, it will deepen and widen the entrance and maneuvering channels in the St. Paul Harbor so that vessel traffic already trying to use the harbor can be safely accommodated. Secondly, it solves the problem of overtopping and surge so that more processing and vessel servicing can take place. This is very important for the safe use of the harbor during the fall and winter crab seasons.

Lastly, the project will correct the problem of amour rock deterioration; a problem that will cost the State and Federal government substantial sums if ignored and not remedied in the next few years. These improvements should also reduce maintenance costs for the navigation and turning basin and facilitate the development of a small boat harbor. The protection of the considerable state and federal government investment in the St. Paul Harbor is a very high priority and improvement will allow the current benefits to the community of St. Paul, the State of Alaska and the nation from the crab and groundfish fisheries to be augmented.

In addition to providing the funding to bring this project through the feasibility study stage, the City has funded and financed a number of harbor and local utility projects that enable the seafood industry to expand the amount of product processed on the island. As the state receives revenue from shore-based processing (it does not receive from product processed outside the 3 mile limit), the expansion of shore based processing on St. Paul is extremely important to the State of Alaska. While continued State participation is subject to appropriation, the Department supports this project and funding as part of the Department's COE Match Program.

Sincerely,

Joseph L. Perkins

Joseph L. Perkins, P.E.
Commissioner

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF LAND
SOUTHCENTRAL REGION

3601 C STREET, SUITE 1080
ANCHORAGE, ALASKA 99503-5937

Rcvd 3/12/96

March 3, 1996

Clarke Hemphill, Study Manager
U. S. Army Engineer District, Alaska
P. O. Box 898
Anchorage, Alaska 99506-0898

Dear Clarke,

Per our recent telephone conversation, the Department of Natural Resources has no objections to the city of St. Paul using the dredged material from your current dredging project at St. Paul for cover material at the landfill or for other local public projects at no charge. Per correspondence with the City of St. Paul, the city will not sell the materials.

If we can be of any further assistance, please feel free to call me at 269-8548.

Sincerely,

Mike B

Michael Bennett
Natural Resource Manager

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services Anchorage
605 West 4th Avenue, Room 62
Anchorage, Alaska 99501

IN REPLY REFER TO:
WAES

FEB - 9 1996

Colonel Peter A. Topp
District Engineer
Alaska District, Corps of Engineers
Post Office Box 898
Anchorage, Alaska 99508-0898

Dear Colonel Topp:

We have been coordinating with your Environmental Resources Section in an effort to qualify maintenance and improvement of tidal flushing in Salt Lagoon, on St. Paul Island, for funds under 1135 monies administered by your agency. In 1989, the Corps built a harbor on St. Paul Island which directly impacted the entrance to the lagoon. Consequently, the tidal activity in Salt Lagoon has been reduced. This lagoon supports an abundance of roosting red- and black-legged kittiwakes and migratory shorebirds.

Recently, we learned from the project manager, John Burns, that 1135 funds will not be available for this project. However, we believe maintenance of Salt Lagoon is very important for the continued support of unique seabird and shorebird resources. A long-term solution may be available through the current dredging project being studied for St. Paul Harbor, and should be included in project alternatives.

We will be writing a Fish and Wildlife Coordination Act report for the dredging project and could assess alternatives through this process. We look forward to your response. Our project biologist, Laurie Fairchild, may be reached at 271-2788.

Sincerely,

Ann G. Rappoport

Ann G. Rappoport
Field Supervisor

CITY OF SAINT PAUL
P.O. BOX 901
ST. PAUL ISLAND, ALASKA
99660
(907) 546-2331
Telecopy (907) 546-3199

Rec'd 2/12/96

February 6, 1996

Clarke Hemphill, Study Manager
U.S. Army Engineer District, Alaska
P.O. Box 898
Anchorage, Alaska 99506-0898

Dear Clarke:

The purpose of this letter is to inform you that the city of St. Paul will not resale dredge material. The city's preferred use for dredge materials is as cover material at the landfill and / or use on other public projects.

Sincerely,

John R. Merculief
John R. Merculief
City Manager

cc: Mike Bennett

CITY OF SAINT PAUL
P.O. BOX 901
SAINT PAUL ISLAND, ALASKA
99660
(907) 546-2331
Telecopy (907) 546-2065

IN REPLY
REFER TO:

December 28, 1994

Mr. John Burns
U.S. Army Corps of Engineers
Alaska District Office
P.O. Box 898
Anchorage, AK 99506-0898

Dear ~~Mr. Burns:~~ John

The City of St. Paul would like to improve the water quality and circulation in Salt Lagoon. As you are aware, the circulation, flushing, water quality and related environs were altered by the construction of the St. Paul Harbor Project. We would like to work with the Corps of Engineers to construct an environmental enhancement project to improve water quality, circulation and flushing of this unique lagoon environment. The lagoon, associated wetlands and uplands, and the spit provide valuable habitat for shorebirds. It is our understanding that under the authority of Section 1135 of Public Law 99-332, as amended and Public Law 102-104, Energy and Water Development Appropriations Act, federal funds have been appropriated for improvements in Alaska. The City of St. Paul would like to be a local sponsor for a project to improve the water quality in the Salt Lagoon area.

It is our understanding that our responsibilities will be:

1. Provide, without cost to the United States, all necessary land easements and rights-of-way relocations of utilities necessary for project construction and subsequent operation and maintenance;

2. Assure operation, maintenance, repair, rehabilitation and replacement during the useful life of the works as required to serve the project's intended purpose;

3. Provide the non-Federal share of matching funds equal to 25 percent of the cost to conduct a feasibility study, prepare detailed plans, specification, and construction of the modifications;

4. Hold and save the United States free from claims for damages which may result from the construction and subsequent maintenance of the project, except damage due to the fault or negligence of the United States or its contractors;

5. Comply with applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1934; Public Law 88-352, 78 Stat. 241, 252); and

6. Execute the Assurance of Compliance pertaining to Title IV of the Civil Rights Act of 1984 (Public Law 88-352, 78 Stat. 241, 252).

Charlotte Kirkwood, City of St. Paul Planning Director has been designated as Project Coordinator for the city. Please contact her with any questions and to arrange a scoping meeting.

Sincerely,
CITY OF ST. PAUL

Larry Merculieff

Ilarion P. Merculieff
As City Manager

Signed on his behalf
by C. L. Kirkwood

cc: John R. Merculiet
Andrey Mandregan
Tony Smith